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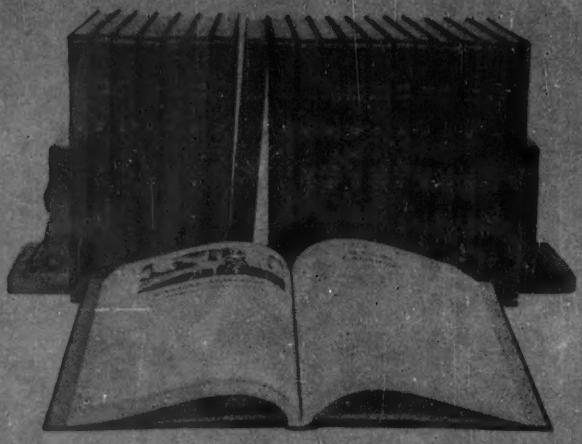

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Water Bird Guide

Audubon Water Bird Guide. By Richard H. Pough. New York. 1951. Doubleday and Co. 352 pages. With 485 illustrations in full color by Don Eckelberry and 138 black and white drawings by Earl L. Poole. $3.50.

In his earlier *Audubon Bird Guide*, Richard H. Pough covered the small land birds of eastern and central North America from southern Texas to central Greenland. In this second field guide he follows the same approach and covers the water birds, game birds and large land birds of the same area. Thus the two books are complementary and this newest one will be heartily welcomed by bird enthusiasts. Both books are sponsored by the National Audubon Society.

North American Elk

The Elk of North America. By Olaus J. Murie. Harrisburg, Pa. 1951. The Stackpole Company. 370 pages. Illustrated, with a frontispiece in color by Walter A. Weber. $6.50.

This outstanding book is a Wildlife Management Institute Publication and a notable addition to literature on the mammals of North America. Its author, Dr. Murie, is probably the world's leading authority on the elk. Living in Jackson Hole, Wyoming, he has conducted extensive research with respect to the elk there, and elsewhere. Maintenance of herds of these native animals depends today upon wise and informed management within the limitation of available habitat, and on the basis of the most complete possible knowledge of the living demands of the elk. Here, then, is both the textbook essential to such management and the story of the antlered monarch yesterday and today, and with a look toward tomorrow. Because of the gradual inroads of civilization the elk became what has been described as a "problem." In this book we have an authoritative and thorough discussion of the "problem."

Bird Songs

A Guide to Bird Songs. By Aretas A. Saunders. New York. 1951. Doubleday and Company. 307 pages. $3.00.

The first edition of this guide to the songs of birds appeared in 1935 and has become a popular publication in its field. It presents a diagrammatic system by which one can learn to identify bird songs and calls. This new edition has been revised and enlarged.

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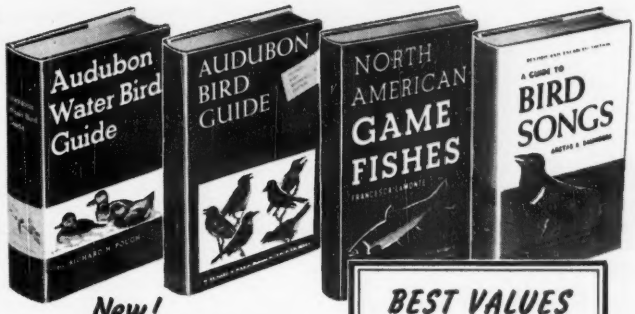

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Nature in Print

By HOWARD ZAHNISER

AS, GRANTED the good fortune, we set off for the ocean or its beaches this summer, we have the chance to take with us two excellent and newly published books that can add greatly to our understanding and enjoyment of the seashore and the sea itself — *The Living Tide*, by N. J. Berrill, interesting and intriguing, and Rachel L. Carson's *The Sea Around Us*, impressive and irresistible, reverent and revealing.

A new edition of Charles Darwin's *On the Origin of Species*, compactly republished by the Philosophical Library, is also at hand, and might well accompany these newly published books for perusal or meditation, fitting in appropriately with these works on the sea and the life of its waters and its shores. Darwin's profundities of observation and speculation comporting well with these other expressions *de profundis*. Darwin is in the indexes of both these new books, of course, and Miss Carson reminds us in a cadenced paragraph that—

"It was from the pages of earth's history written on the lava fields of the Galapagos that young Charles Darwin got his first inkling of the great truths of the origin of species. Observing the strange plants and animals — giant tortoises, black, amazing lizards that hunted their food in the surf, sea lions, birds in extraordinary variety — Darwin was struck by their vague similarity to mainland species of South and Central America, yet was haunted by the differences, differences that distinguish them not only from the mainland species but from those on other islands of the archipelago. Years later he was to write in reminiscence: 'Both in space and time, we seem to be brought somewhat near to that great fact — that mystery of mysteries — the first appearance of new beings on earth.' "

Darwin's own first edition, Dr. Darlington explains in his foreword to this new printing, "has never been reprinted before" — an edition more positive, less hesitant and less compromising, it appears, than Darwin's later, longer, and "looser" editions that have ever since been used. Reviving the book as Darwin first presented it, Dr. Darlington believes, will help "in rescuing Darwin from ignorant neglect and in protecting him from corrupt adulation." Thus presented, "unspoilt by later hesitation, unimpaired by yielding to the trivial and captious critic, . . . its strength and its weakness unconcealed," the *Origin of Species* Dr. Darlington views as "not a basis for dogma, but a guide to inquiry. And," he concludes, "it is as an essay in scientific inquiry, applied freely, unrelentingly, and without fear of any master, that it will remain to refresh and inspire succeeding generations of men."

Clearly printed in a lightweight pocket- or purse-size volume, this Darwin goes well with one moving about, or "waiting," in our modern urban to-do. The concentrations that it demands will surely result in a dismissal, for the time being at least, of the distractions that come in our "exile" from the sea, which so saddened Edna St. Vincent Millay, as she wrote her poem "Exiled:"

". . . caught beneath great buildings,
Stricken with noise, confused with light."

And many would doubtless find this germinal dissertation a most fortunate prelude to such newly inspired discussions as Dr. Berrill's *The Living Tide* and Miss Carson's *The Sea Around Us*.

Dr. Berrill, who is professor of zoology at McGill University in Montreal, Canada, conducts for us in the series of good-humored, variety-spiced chapters of his book a sort of guided journey up the Atlantic Coast of the United States — "a slow crawl" up the coast, as he himself describes it, "from the Tortugas to Maine, from warm water to cold, from a marine fauna which is tropical or subtropical to one that is essentially subarctic — from the source of the Gulf Stream, following its northward sweep until it leaves our shores for Europe, to be replaced in the Gulf of Maine by cold water coming down from the North." We start with Dr. Berrill on his way to the Tortugas to get to know "marine life for its own sake, a wonderful kind of busman's holiday," as he describes it, on which he intended to study "whatever tunicates" he found. One gets the idea that his book likewise is a kind of "busman's holiday," the indulgence of a classroom lecturer invited to some outside gathering for a freer, easier discourse with his lay readers. Of the great turtles on Loggerhead Key in the Dry Tortugas, of Maine lobsters, and of crabs, sponges, oyster-farming, and other seashore interests in between we learn in some detail. Of many, many other aspects of the life of the tide lands we learn enough to excite wonder and entertain us in the wealth of the curious. As Raymond T. Bond, vice president of this volume's publishing house, remarks: "Professor Berrill is an eminent scholar with a real flair for everyday human writing." Authoritatively but informally, often in the first person or directly in the second, he writes for us the amazing facts of his observations, with now and then a philosophical comment — an explanation of his interest, a pondering of ultimate meanings, a reflection on the destructiveness of man.

The scientist, he comments, is "much the same" as the "true artist" who "*must*, under compulsion, express in some medium what he sees and feels." In the course of a pleasant essay on rockpools — as elsewhere — Dr. Berrill expresses the mystery of all our understanding: "If you look into a pool like this and comprehend what you see, including the brooding reflection of your own face, you will embrace the universe — for the beginning and the end of living time are there before you." In the course of a one-chapter "Pacific Interlude," Professor Berrill assails with a jibe the too-common rationalizing of human wantonness with marine life because of its amazing plenitude, pointing out that the abalone's "insurance against race-suicide is no protection against murder." Elsewhere, he observes that "Nature, man excluded, does pretty well when left alone," and thus his readers are not untouched with philosophy and morality though for the most part they are entertained and light-heartedly informed with the marvels that Professor Berrill has woven into these tales of his holidays.

Miss Carson's homage to *The Sea Around Us*, one will soon perceive, is something quite different from an entertainment fashioned from the lore of the sea — or its science. A rhapsody of facts expressed in the cadence of a prose that itself conveys something of the majesty and profundity of her subject, Miss Carson's book is literature of a high order. One can read it not only for its deep understandings, its wealth of information, but likewise for its own excellence. As in *Under the Sea Wind* Miss Carson achieved a peculiar excellence in writing fiction expressing her own sympathetic understanding of other forms of life, so in *The Sea Around Us* she has attained a prominence in that literature created by those writers who — although inspired by personal experience — are nevertheless dependent for the knowledge of their writings on the ever-growing multitude of scientists, or fellow scientists, for Miss Carson herself is a marine biologist as well as writer and editor. Here is a model of a first-hand creative interpretation of a great phenomenon — even of life

Sea Shells

By DORIS V. SMILEY

Restless nomads of the ocean,
Tribesmen from what teeming shores,
Deep lie the continents of coral
Your intrepid horde explores.
Hardy wanderers of water
In whose tides you still retain
Each distinctive shape and pattern,
Every pink and purple stain.

If we ask why one is shallow,
Others chambered, plump of line,
Still more, furled like small umbrellas,
Flat ones wrought with flower design,
We would question a Great Sculptor
Long experienced, skillful, sure . . .
One whose work, through tide and tempest,
Delicately will endure.

itself. Its reading will first entice concentration and then inform, inspire, tingle, and profoundly satisfy. Encompassing a wealth of information, it is in one sense as objective and impersonal as a fact, yet it pulsates with vitality. Read it!

In three parts entitled "Mother Sea," "The Restless Sea," and "Man and the Sea About Him," the book has fourteen chapter headings that are themselves eloquent of its contents — The Gray Beginnings; The Pattern of the Surface; The Changing Year; The Sunless Sea; Hidden Lands; The Long Snowfall; The Birth of An Island; The Shape of Ancient Seas; Wind and Water; Wind, Sun, and the Spinning of the Earth; The Moving Tides; The Global Thermostat; Wealth from the Salt Seas; The Encircling Sea. Quotations from the poets are at chapter heads as suggestive texts, and a list of other books with Miss Carson's comments — coming at the end of this infectious volume — make one wish for an ocean voyage indeed, with a whole trunkful of books.

In a synopsis of evolution at the conclusion of "The Gray Beginnings" chapter, Miss Carson writes certain paragraphs that can perhaps serve better than further comment both to epitomize her book and to sound the chord of her prose:

"Among the land mammals," she writes, "there was a race of creatures that took to an arboreal existence. Their hands underwent remarkable development, becoming skilled in manipulating and examining objects, and along with this skill came a superior brain power that compensated for what these comparatively small mammals lacked in strength. At last, perhaps somewhere in the vast interior of Asia, they descended from the trees and became again terrestrial. The past million years have seen their transformation into beings with the body and brain and the mystical spirit of man.

"Eventually man, too, found his way back to the sea. Standing on its shores, he must have looked out upon it with wonder and curiosity, compounded with an unconscious recognition of his lineage. He could not physically re-enter the ocean as the seals and whales had done. But over the centuries, with all the skill and ingenuity and reasoning powers of his mind, he has sought to explore and investigate even its most remote parts, so that he might re-enter it mentally and imaginatively.

"He fashioned boats to venture out on its surface. Later he found ways to descend to the shallow parts of its floor, carrying with him the air that, as a land mammal long unaccustomed to aquatic life, he needed to breathe. Moving in fascination over the deep sea he could not enter, he found ways to probe its depths, he let down nets to capture its life, he invented mechanical eyes and ears that could re-create for his senses a world long lost, but a world that, in the deepest part of his subconscious mind, he had never wholly forgotten.

"And yet he has returned to his mother sea only on her own terms. He cannot control or change the ocean as, in his brief tenancy of earth, he has subdued and plundered the continents. In the artificial world of his cities and towns, he often forgets the true nature of his planet and the long vistas of its history, in which the existence of the race of men has occupied a mere moment of time. The sense of all these things comes to him most clearly in the course of a long ocean voyage, when he watches day after day the receding rim of the horizon, ridged and furrowed by waves; when at night he becomes aware of the earth's rotation as the stars pass overhead; or when, alone in this world of water and sky, he feels the loneliness of his earth in space. And then, as never on land, he knows the truth that his world is a water world, a planet dominated by its covering mantle of ocean, in which the continents are but transient intrusions of land above the surface of the all-encircling sea."

On the Origin of Species by Means of Natural Selection, or The Preservation of Favored Races in the Struggle for Life. By Charles Darwin. (A Reprint of the First Edition). New York: Philosophical Library. 1951. xxii + 426 pp. (4¼ x 6⅝ in.), with diagram of variations, foreword by C. D. Darlington, and index. $3.75.

The Living Tide. By N. J. Berrill. New York: Dodd, Mead and Co. 1951. 256 pp. (5¾ x 8⅛ in.), with 26 photographs on 16 plates, end-paper graph of evolution, and index. $4.

The Sea Around Us. By Rachel L. Carson. New York: Oxford University Press. 1951. vii + 230 pp. (5 ¾ by 8⅛ in.), with front-end-paper reproduction of an old map, *Il Mare di Amazones*, back-end-paper reproduction of Benjamin Franklin's map of the Gulf Stream, reproductions of two fathograms, two hemisphere graphs showing current systems of the Atlantic and Pacific, 15 drawings by Katherine L. Howe on a "Chart of the History of the Earth and Its Life," suggestions for further reading, and index. $3.50.

Maine Orchids

The Orchids of Maine. By Jean Elizabeth Wallace. Orono, Maine. 1951. The University Press. 80 pages. Illustrated. $1.00.

Although the orchids found in the State of Maine cannot be compared in size and showiness with their relatives in tropical areas, these State-of-Mainers make up for it in elusiveness and delicacy. They are rarely abundant, which gives an added thrill to knowing them, and adds to the importance of a type of appreciation that allows the plants to remain undisturbed where they naturally grow. In order to preserve them it is necessary to know them, and Miss Wallace has opened the avenue to this knowledge.

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About the Penguins

Sexual Behavior in Penguins. By L. E. Richdale. Lawrence, Kansas. 1951. University of Kansas Press. 316 pages. Illustrated. $5.00.

L. E. Richdale, New Zealand naturalist, is a very patient man. For ten years he had a group of yellow-eyed penguins under strict observation, prying into their lives as a group and as individuals. He has written of some of these observations in *Nature Magazine*, but in this book he goes into greater detail. He also includes comparative information on other species of penguins that have been studied, and on the behavior patterns of other birds. Thus the book is not as specialized a text as its title might indicate. Besides the interesting information it imparts, there is a certain excitement inherent in the story of the author's long observation. In fact, one associate of the author's said that Mr. Richdale had virtually become a penguin himself in order to ferret out his facts. Although the naturalist describes some of the almost-human activities and actions of the birds in human terms, he is careful to define just what he means and to avoid anthropomorphic pitfalls. While of special interest to ornithologists, the book also has a general interest because penguins are individualists in the bird world.

How About Climate?

Climate in Everyday Life. By C. E. P. Brooks. New York. 1951. Philosophical Library. 314 pages. $4.75.

Climate, which is the "whole long-period assembly of weather conditions," goes on and on and governs the general pattern of lives under differing climatic conditions. Weather is the changing aggregate of atmospheric conditions from day to day and affects lives temporarily. This interesting book is concerned with the former, and with the historic and present affect of climate upon races and peoples. It discusses the ways of "living with climate" in different areas, climate as an enemy, and ways in which we can control climate so far as individual adaptation to it is concerned.

Nature's Year

Nature through the Year. By Frances Pitt. New York. 1951. The Macmillan Company. 300 pages. Illustrated. $3.75.

For anyone who knows or is interested in the wildlife of the British countryside, this book will be a delight. Written by one of Britain's popular Nature writers and illustrated by her photographs, the entertaining and informative book takes one on year-around excursions with the animals of the author's native country.

Civic Annual

American Planning and Civic Annual. Edited by Harlean James. Washington, D. C. 1950. American Planning and Civic Association. 192 pages. $3.00.

This annual is a record of recent civic advance in the fields of planning, parks, housing, neighborhood improvement and conservation of natural resources. It includes addresses given at the National Citizens' Conference on Planning for City, State and Nation, and reports made at the annual meeting of the National Conference on State Parks.

Nests in the West

Birds' Nests of the West. By Richard Headstrom. New York. 1951. Ives Washburn, Inc. 177 pages. Illustrated. $3.00.

When you come upon a vacated nest of a bird do you have any idea which bird built it? In this interesting field guide the author introduces you to the bird through its home. The guide covers more than four hundred birds found west of the one hundredth meridian, and is a companion book to his earlier *Birds' Nests*, which treated with bird homes east of the Great Plains.

Reed Guide Reissued

Bird Guide. By Chester A. Reed. New York. 1951. Doubleday and Company. 238 pages. Color illustrations of 222 species. New and revised edition. Cloth bound, $1.50; fabrikoid bound, $1.95.

When first published in 1906 the Reed *Bird Guide* was among the pioneers in providing a popular and handy field identification text for amateur bird enthusiasts. Now, with revision and complete review by Dr. John W. Aldrich of the U. S. Fish and Wildlife Service, this guide appears once more and provides an excellent introductory field book to the land birds east of the Rockies.

Man and Behavior

Man in Nature and Behavior. By J. M. Martinez. New York. 1951. Philosophical Library. 319 pages. $4.25.

This is a study of Man and the forces that move him to action as approached from the biological and psychological points of view.

Colorado Spiders

Guide to Some Common Colorado Spiders. By Walker Van Riper. Boulder, Colorado. 1951. Univeristy of Colorado Museum. 24 pages. Illustrated. $.25.

This leaflet is not intended as a guide to the many spider species found in Colorado but rather an in introduction to some of the more common ones. The author has found particular pleasure in photographing spiders and in studying them.

At Derrybrook

Announcement of the 1951 program of Nature and outdoor activities at Derrybrook came to us very late, but since the season continues until September 30 there is possibly opportunity to take advantages of the superior offerings at this center. Full information may be obtained from Miss Catherine T. Hammett, Derrybrook, South Londonderry, Vermont.

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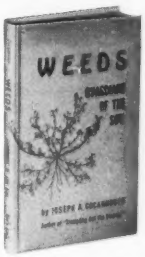

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By Way of Report

A GRANT of ten thousand dollars has just been made to the National Association of Biology Teachers by the American Nature Association, with the aid of the Charles Lathrop Pack Trust, to stimulate an increased emphasis on the teaching of conservation and resource-use education by biology teachers in all the States. Dr. Richard L. Weaver, President of the National Association of Biology Teachers, will serve as coordinator for the three-year project and will have the assistance of an executive committee of seven members, nine regional chairmen, and a conservation chairman in each State. The executive committee consists of: Miss Lydia Elzey of Pennsylvania State College, State College, Pa.; Dr. E. Laurence Palmer of Cornell University, Ithaca, N. Y.; Dr. Howard Michaud of Purdue University, Lafayette, Indiana; Mr. John Harrold, Secretary-Treasurer of the National Association of Biology Teachers of Midland, Michigan; Dr. George Jeffers of Farmville State Teacher's College, Farmville, Va., and Dr. Leo Hadsall of Fresno State Teachers College, Fresno, California.

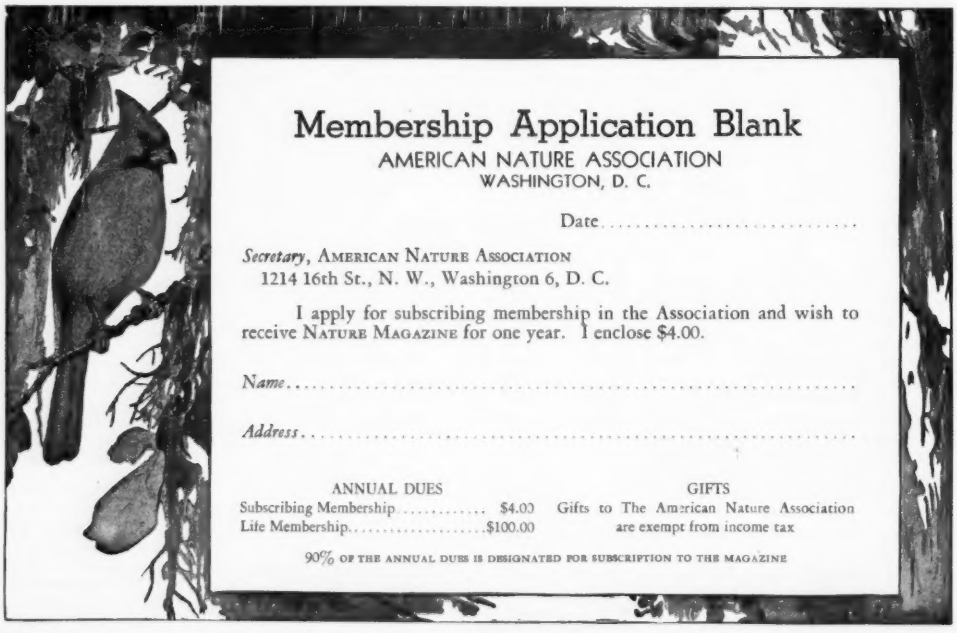
The project will include regional and state work conferences of biology teachers to review programs in conservation education, exchange experiences on the relative values of various teaching techniques, and to prepare some unit teaching materials.

The first conference is scheduled for Indiana in October, and the first regional conference for December in Philadelphia, with representatives of the New England, middle Atlantic and Atlantic coastal States, south as far as North Carolina.

An advisory committee composed of representatives of various conservation and professional educational groups is being organized to advise and assist the Project Committee. This group will hold its first meeting early in September to help complete plans for the state and regional work conferences.

Lists of outstanding biology teachers who have already given leadership in this field are being collected now by the Project Committee to assist in gathering the kind of information needed for this project. The committee would appreciate receiving the names of teachers who have displayed unusual interest in the teaching of conservation. These can be sent to Dr. Richard L. Weaver, P.O. Box 5424, State College Station, Raleigh, N. C., or to other members of the executive committee.

A final report and a series of preliminary reports are planned. These will be published by the American Nature Association, the National Association of Biology Teachers, and other organizations cooperating in carrying out this program.



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Contents Noted

WITHOUT doubt the announcement that the seedless watermelon has been achieved by the plant scientist will be hailed generally with applause. Our first impulse was to join in the acclaim; then we began to have our doubts. Consumption of a watermelon has always seemed to us to be a task comparable to that of eating a shad. Separating the sweet, red pieces of the melon from their companion ranks of seeds, and the fine flesh of the shad from that fish's amazing bony structure, call for special techniques, achieved only through experience, patience and a special brand of epicurean loyalty. Both are eaten with a feeling of accomplishment, of obstacles overcome, and, it seems to us, the taste is subtly enhanced thereby. A watermelon feast is no more dainty an experience than cracking out the meat of a hard-shelled crab, another gustatory excursion endowed with individuality. The seedless watermelon will be eaten quickly, easily and unexcitingly. While we admire the ingenuity of the plant breeders in their tinkering with the melon's chromosomes, we cannot escape the feeling that they are robbing us of something. We will miss the slippery seeds.

WHILE in a reactionary mood and having our taste buds in an anticipatory state, we wish to shed a tear for other dietary experiences that "progress" has stolen from us. We write, of course, as one who must be satisfied with what the city stores permit us today. We deeply resent, for example, being unable to go into a store and buy a basket of luscious Concord grapes, or any other formerly basketed grapes, for that matter, except the tough-hided Malagas. They tell us that the grape-juice makers, and, we suppose, the wine-makers, buy up all the vineyard output and whisk it away. So all we have left is a youthful memory of plucking a bunch of Concords from the home grape arbor and squeezing the sweet heart of grape after grape against eager lips. No bottled grape juice or wine can ever supplant that experience, and whole generations of city children are growing up, ever to be denied that opportunity.

VIVID recollection of the grapes that used to be, brings to mind the incomparable odor of the cold cellar on a winter's evening when we were sent down to bring up some apples from the apple barrel. The cold cellar has been turned into a recreation room in the city home of today. No longer are there shelves on which stand platoons of cherries, pears and other fruits canned by Grandmother and Aunt Jenny and Aunt Phoebe as the fruits came ripe from the backyard trees. Now we get the fruits mostly from the store shelves, or reach into an Arctic contraption containing ingenious boxes whose contents are as frozen as a glacier. The boxes bear pictures of what their contents once were, but rarely does the interior taste much like the original as it came fresh from the garden. We would trade the entire contents of one of these freezers for a heaping dish of fresh red raspberries mixed with shining red currants. It is frightening to think that millions of city people will soon be eating frozen peas and thinking that a fresh garden pea really tastes that way. We must, of course, concede that some frozen foods seem to lend themselves better than others to the techniques of freezing. However, our gustatory experience with various fruits and vegetables in this form has been more disappointing than otherwise. Perhaps the know-how will improve — we certainly hope so — but until it does we will yearn for enough space to permit us to raise the fresh versions.

BEFORE we leave the area of food we would like to record ourselves, as a loyal New Englander by birth, in favor of pending legislation in the Congress to define by law just what a lobster is. Senators Owen Brewster and Margaret Chase Smith of Maine have introduced S.1514 to that end, and members of the House from Maine have chimed in with identical bills. The bill provides that "for the purposes of the Federal Food, Drug and Cosmetic Act the word 'lobster' shall mean, and be included in the common and usual name of, only that species of decapod crustaceans of the genus *Homarus* known as *Homarus americanus* and found in the Atlantic waters contiguous to the North American coast line from the vicinity of Henley Harbor, Labrador, on the north, to the vicinity of Cape Hatteras, North Carolina, on the south. This species is distinguished from others in having twenty pairs of gills, and in having its first three pairs of legs terminating in chelae, or pincers, the first part of which are large and massive." The Maine legislators — and they should be joined by others in States of the East Coast —demand that a species known as *Nephrops norvegicus*, from Norwegian waters, and the *Homarus gammarus* of European waters, not be called lobsters. Furthermore, they insist that the Florida crayfish, or other crayfishes, which are innocent of any "large and massive" foreclaws, have no right to be presented to the epicure as lobsters. Nor does that right extend to members of the Palinuridae family, which are often given the popular names of rock lobster, spiny lobster, red lobster, thorny lobster; or members of the Scyllaridae family, one of which is called a Spanish lobster. And all of the crawfishes, or crayfishes, which too often sneak on menus as lobsters, are to be known for what they are and not to assume the name rightfully the property of the regal lobster of Maine and points south. So, having been reactionary in the gustatory exploration that started this page, we will be positive and progressive, and hope that there is a real upsurge of support for calling a lobster a lobster, even though a frozen string bean may still, physically and technically, if not in point of taste, be entitled to be called a string bean.

—R.W.W.

A female broad-tailed hummingbird poses for its portrait perched on a Willis feeder. The photographs with this article were made with the high-speed electronic flash developed by Dr. Harold E. Edgerton and associates at Massachusetts Institute of Technology. Exposure time was about 1/5000 of a second at f.32. The bird is much enlarged.

Hospitality for Hummers

By WALKER VAN RIPER

A red, flower-like cup holds the syrup prepared for hummingbird visitors and enjoyed by a female broad-tailed hummer. This is one of several devices that will attract these birds to the garden.

NEARLY everywhere throughout the United States there is at least one species of hummingbird, resident and nesting during the summer months. Along the eastern seaboard, from Florida to Canada and as far west as Nebraska, the ruby-throated is the sole representative of this most interesting family of birds. Wintering in Central America, it makes its northern migration into this country by two routes, either across the Gulf of Mexico or up the Mexican coast and through southeastern Texas. In the extent of its breeding territory, covering as it does the whole eastern half of the country, and in numbers, this colorful mite probably far surpasses any of the other hummingbird species coming into this country.

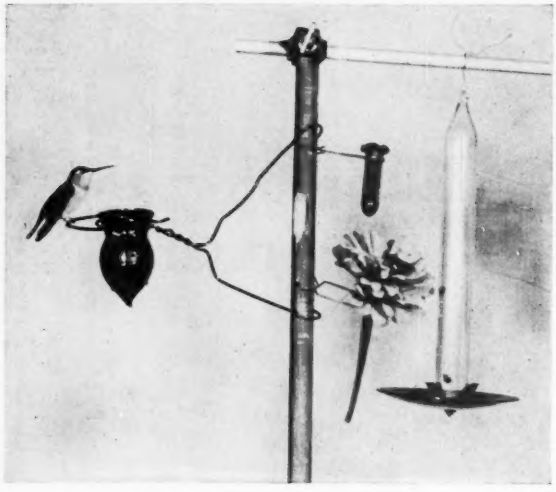
In Colorado, and throughout the Rocky Mountain region, the broad-tailed hummingbird is the leading species. In many ways it is similar in appearance and habits to the ruby-throated. In addition, the black-chinned, which is common farther south, nests in a few Colorado localities, and the calliope and the rufous come through in migration. Arizona, California, and Texas, particularly along their southern borders, welcome the balance of our species — buff-bellied, white-eared, Costa's, Rivoli's, blue-throated, Allen's, and broad-billed. Furthermore, California has the only species — Anna's — that stays in this country the year around.

All of these lovely little birds feed at flowers, where they obtain the nectar and insects upon which they live. All of them, also, have been attracted to man-made gardens and to supplies of artificial nectar. Shyness is distinctly not a hummingbird failing, and, when a suitable source of food is discovered, the presence of human beings, larger birds and other animals seldom frightens them away.

Certain flowers, like the honeysuckle and the trumpet vine, are particularly attractive to hummers. The late Frank Bené, whose book on the feeding habits and related behavior of the black-chinned hummingbird is a fine contribution to our knowledge in this field, made a study of the published reports of special flowers favored by these birds of the whirring wings. Among the cultivated plants, in addition to those mentioned, Bené found the more important to be salvia, pentstemon, gilia, anchusa, lantana, verbena, columbine, nasturtium, larkspur, hollyhock, and gladiolus.

If one wishes to make hummingbirds a regular feature of the garden, however, (and to my mind there is no other creature capable of contributing so much in the way of beauty and interest) something more than flowers should be provided. That is a plentiful and dependable source of nectar, or sweet syrup, made readily and attractively available in suitable feeders.

The standard syrup is a solution of one part of white sugar in three parts of water. This formula is widely used, and has been found to be agreeable to the tastes of all our hummingbird species. However, other mixtures have their advocates. Some use honey rather than sugar, and Bené found one part of water to seven parts of honey acceptable. Honey may also be added to the standard sugar solution, either as flavoring or as an additional nutriment. Likewise, orange juice may be added. A hummer soft drink of one part honey, one part canned orange juice, and two parts water, has



Four types of artificial hummingbird feeders, all of which have proved successful in attracting these colorful mites. Certain garden flowers, however, must be provided to bring them to the garden first.

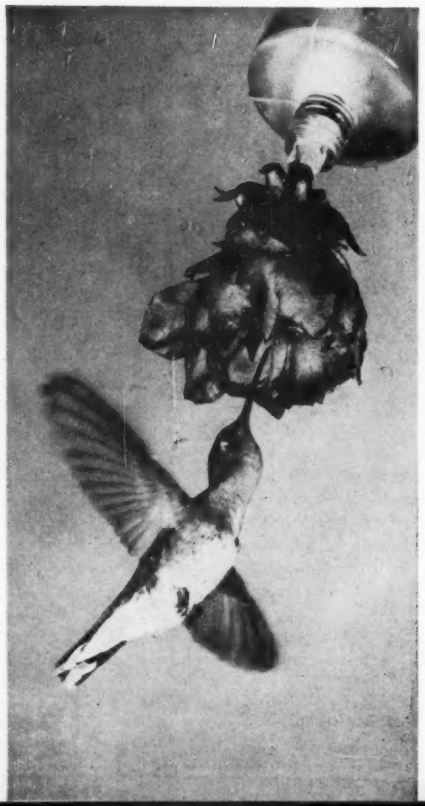
been reported as effective. Bené experimented with brown sugar and honey solutions, as well as with the standard formula, and came to the conclusion that some hummers of the same species liked one thing and some another. This points up a significant fact — hummers are highly individualistic, and this is one of their most fascinating characteristics.

In the bird houses at the Bronx Zoo and the St. Louis Zoo hummingbirds are kept in captivity. Success in maintaining the birds depends, of course, on proper diet, and this has been attained by adding to the basic sugar-syrup various protein and vitamin supplements designed to take the place of the nectar and insect foods utilized under natural conditions. Some measure of the success achieved may be seen from the fact that, at this writing, there is a male Costa's hummingbird in perfect health and feather in the Bronx Zoo, where he has been for more than five years.

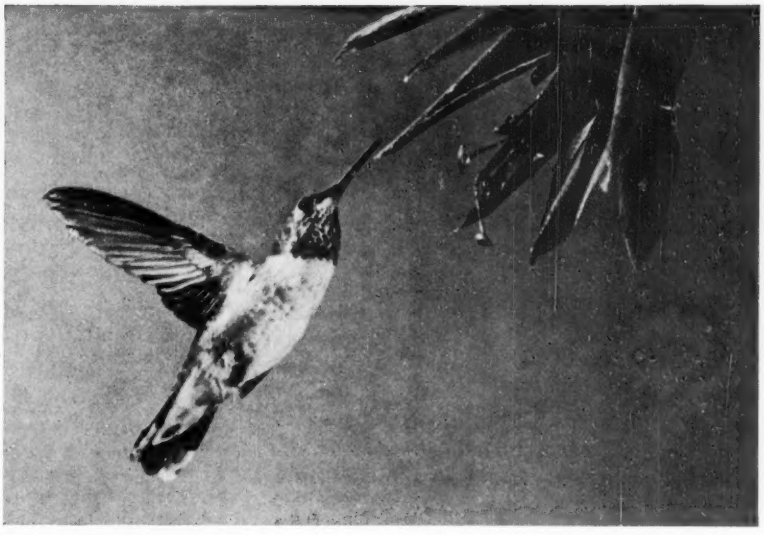
Great ingenuity has been shown by those who enjoy wild hummingbirds around the home grounds, in the invention of feeding fountains and containers. In fact, more than one kind of these devices is advisable, particularly for one who is starting from scratch to attract the hummers. First of all, it must be remembered that there is nothing inherently inviting to the birds in any form of syrup container. Hummingbirds, of course, are used to flowers and suitable blooms must be provided as the first step in bringing these avian guests to a garden.

Once hummers are seen to be feeding at certain flowers, the next step is to introduce them to the artificial sources of nectar. This may be done in various ways. Small containers, colored and shaped to resemble flowers, may be placed among the flowers or fastened to flower stalks. Or, the blossom of a flower of the kind the hummers are visiting may be placed over the mouth of a vial and fixed where it is likely to be probed. Bené did this easily with the nasturtiums in his garden. Once the birds discover the syrup, which, of course, is sweeter and far more plentiful than that supplied by any flower, the critical stage in extending hospitality is passed. From then on it is easy to train the wee nectar-lovers to use more convenient and larger containers. Once the process of education is over, it is possible to do with no more than one or two feeders in a garden, these being of sufficient capacity so that servicing is necessary only two or three times a week.

This "dripper" feeder, combined with the red bloom of the cane cactus, attracts a female blue-throated hummer.



One of our illustrations shows various kinds of feeders. The cup on the left, and on which the bird is perched, was made from the top of a common, chemical laboratory thistle tube. The stem was cut off and flame-sealed, and the outside of the cup painted with bright red enamel. The holder was made from a wire coat-hanger. This one had two wires forming the hook. One was bent to hold the cup, and the other was arranged to make a perch for the feeding bird. This type of apparatus is easy to make, for any wide-mouthed bottle can be used in place of the thistle tube. It can be adapted, also, to any kind of support, and the hummers seem



"Brownie," young male rufous hummingbird, goes for an artificial flower at the end of a "dripper" feeder.

to like it. Also it is easy to service, and this is important, because the food should, of course, be kept fresh and clean. The perch feature is one that hummers like, and with an open cup of this sort other birds may be attracted, for the hummer is not the only bird with a "sweet tooth." I have seen house sparrow, yellow warbler, hooded oriole, Scott's oriole, and tanager acquire the feeding habit.

On the opposite side of the stand is a commercial product. It is a little test tube, flared at the top with a handy clasp for fastening it where wanted. It comes in various colors and can be attached to the stalks of flowers at which hummers are seen to be feeding. It is one of the handiest and best devices for introducing the birds to artificial nectar.

Below and inserted in a zinnia blossom, is another "introducer." This is a short length of glass tubing, flared at the top, drawn to a sharp point at the bottom, and painted a bright color. Both of these devices should be used liberally since the first sip by a hummer is so largely a matter of chance that success is likely to be in direct proportion to the number of feeders used.

The other device pictured is a test-tube feeder. This is made from a twelve-inch test tube, one inch in diameter, to the mouth of which a four-inch watch glass is fastened with a brass spring clamp. When inverted this dispenses syrup into the dish at a constant level. I have used this device for many years and confess that I am rather partial to it. It is a bit on the fragile side, but it is also rather decorative, holds a good supply of syrup, and the birds take to it readily. Making it is not difficult if one has had a little training in working glass. An eye must be drawn in the end of the test tube by which to hang it, and a hole is required in the center of the dish for fastening the clamp.

The "dripper" feeder proved to be at-

(Continued on p. 386)

Shyness is not a characteristic of hummingbirds. The young rufous hummer comes to the cup filled with syrup and held in the author's hand.

Curiosity—Small and Large

A True Story

By E. SUSAN McNULTY

Illustrated by Vega Ihsen

★

"Rambling one day in late summer, I came upon a group of especially perfect pine trees, a beautiful little grove. . .a veritable sanctuary."

IT ALL happened in an exquisite spot on pastureland in the Berkshire Hills of Massachusetts.

Rambling one day in late summer, I came upon a group of especially perfect pine trees; a beautiful little grove. Drawing aside one of the thick branches to see what lay within the trees' embrace, I found a veritable sanctuary concealed from all except adventurous, beauty-loving souls. Gently, as though on almost sacred ground, I stepped past the "curtain" I had drawn, and breathed deeply the fragrant breeze that swept so strongly up the hillside and sifted softly through the little place. Sinking gratefully on the sweet old pine-needles, I comfortably cushioned my head against a convenient stone and prepared to enjoy a better acquaintance with my lovely find.

Within the cool dimness of the little grove, quiet reds, browns and greens contrasted welcomingly with the hot, dry pasture through which I had just passed. The proud old pines, their low-sweeping branches reaching caressingly downward, stood firmly rooted in the colorful, sun-splashed carpet of old needles, the swaying branches of the encircling trees forming soft green walls. Toward the west, giving promise of future sunsets to be enjoyed, a long, window-like opening let in the sunlight and a glorious view of range after range of distant hills. I tilted my head backward, the better to see up and along the pines' mossy trunks. Above me, slender, interlacing branches, brittle little twigs and tender green pine-needles made perfect cobwebs against the clear blue sky, making a delicate canopy over all.

Perhaps I dozed for a moment in the peace of this haven. But, always Nature-conscious, I was instantly brought alert by some faint sound. I cautiously raised my head. A tiny black and white "something" was moving near me, partly concealed by the trunk of one of the pines. "Was it a black and white warbler," I sleepily pondered? Then a better view proved it to be a chickadee — no, two chickadees, dainty little mites. Carefully I turned my head to look at the pair. Then, quicker than thought, chickadees, all chattering loudly at once, seemed to appear from all directions. Suddenly the whole grove was alive with a happy, but evidently excited, little "mob." Chickadees, of course, are always friendly little things, but why all the excitement? Had these particular chickadees never before seen a human being? That did not seem likely, although without doubt some among them were mere "youngsters," with little "worldly" wisdom. It all was most mystifying, this sudden convention.

By this time, curious and excited myself, and anxious not to lose one fraction of a moment of an enchanting experience, I slowly arose to a half-kneeling position so that I might see more easily. Like pretty leaves blown by a gay breeze the little birds fluttered above and around me. Without question they were all "talking" loudly about me — to my face, behind my back, on either side. So near, indeed, did they come that I could have touched or taken in my hands any one of a dozen or more of the pretty flock. The very air seemed full of them. Each branch, big or little, seemed to hold one or more of the birds, some quietly looking on, others — little acrobats that they are — gracefully swinging from every kind of position. Perky black velvet caps tipped stylishly forward on each tiny head, many pairs of bright black eyes twinkled roguishly as their sweet voices questioned me, "*Who*'re you?". . . "*Who*'re you?", or others, more persistently, "Where did you *come*, come from?". . . "*Please* tell."

Bewildered, entranced and stirred, I lived to the full each precious moment, afraid lest I do something to break the precarious spell. A peculiar feeling, almost of embarrassment, came over me. Whimsically the

thought crossed my mind: "So did Snow White feel when awakened to find herself surrounded by the lovable little dwarfs, who also were so frankly inspecting *her*?"

At last, and longing for blueberries from the pasture as "bait," I held out a hand and gently began speaking in low tones to my little inquisitors. A strange bond was holding us; an intimacy and mutual understanding that was certainly unusual. No fear was here, merely a pretty curiosity; no hurried desire to fly away from this big creature that had invaded what was, perhaps, one of their favorite haunts.

Then came the elusive sound of still more wings! Two other birds of a quite different kind now joined the magic circle, perhaps attracted by the excitement in the grove. I held my breath. "Warblers," I exulted, "two female black-throated blue warblers!" I wondered whether *all* the birds of the hillside were coming to visit me in my retreat. These newcomers were little, olive-green birds, each feather, like that of exquisite "cedar waxwings," carefully groomed. A touch of ivory-white was placed — just so — on each small wing, adding greatly to the general effect of the demure little ladies.

How had they gained the courage to join the chickadee throng — and me? However, example is a good teacher. To prove it, and not to be outdone by the other, bolder birds, one warbler perched herself companionably close beside the nearest chickadee and cocked a red-brown eye at me, in amusing contrast to the other's little beady black one. How I hoped the male warblers, so different in coloring, would come! Then, there was one handsome fellow with blue-gray back, black velvet cheeks, throat and sides, and white underparts. Nor was he loath to display his beauty to the full, for, with all the assurance possible, he flew swiftly close beside me, as happy, as keenly interested, and as prettily unafraid as any other of the feathered company.

Now I knew, beyond a shadow of a doubt and as the natural outcome of a "communion of spirit" we enjoyed, that at any moment I could expect to have either the gay little chickadees or the usually so timid warblers alight on my hands, or head, or shoulders. Eagerly I awaited that moment.

But it was not to be. For gradually I was conscious of that strange feeling of being watched.

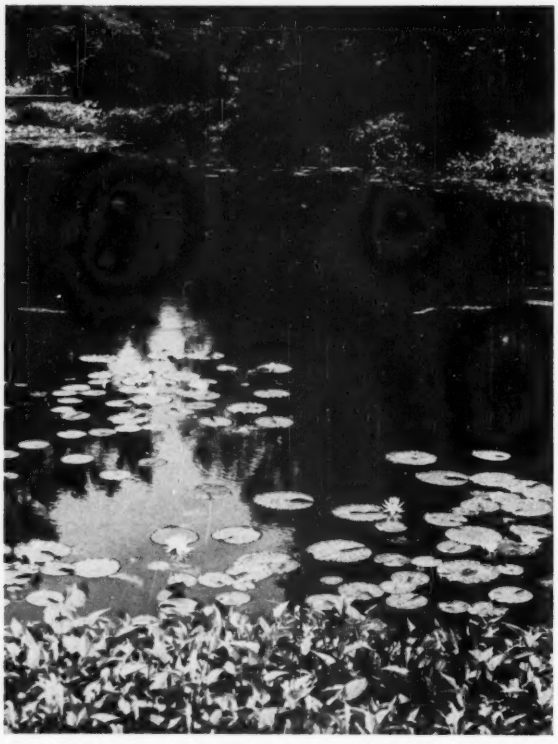
Reluctantly I turned my head away from the scene that was so absorbing. There to the right of me, not more than ten feet away and pushing relentlessly through our thick screen of pines, was a large white star on a huge black face, and one rolling, staring eye! The sudden transition from pure beauty to this weird apparition left me dazed. The awakening to a stark reality was *too* sudden, too startling for quick adjustment. There was a flash of wonder: "What ever is this beastie?" "Was it some creation of a far-distant past?" No, this certainly was no ethereal creature of another world, Mars or otherwise, but just a COW!

Then I came alive. Of course, it was a cow strayed far off from the large herd that I positively *knew* to be acres and acres distant. Still, how could it have crept upon us, unheard, in this fashion? Evidently it, too, had been drawn by the strange "goings-on" in a place that ordinarily would have been so quiet, and *also* was curious — or worse! I gave a quick thought to the pines, wondering if they were at all "climbable." Of course, I remembered the kind assurances of my many farmer friends that cows are "always" and "only" — "very curious animals." But how was one to be sure of this particular cow?

The bovine intruder was now only eight feet away and still coming. I was taking no chances. Curiosity in *this* size needed a far different technique than did that offered by my tiny friends, I resolved. So, even at the risk of breaking the bond with them, I fairly hurled at the intruder, a low-pitched but emphatic "Scat!" With a wildly terrified snort, this unwelcome visitor noisily tore away. My tiny and inquisitive callers likewise had fled.

Once more over my sanctuary the "forest's holy hush" descended. But, as though to console me in my disappointment, from the nearby woods shadowed depth there stole to me, lingeringly, quietingly, "like liquid pearls fresh showered from heaven," the treasured notes of a solitary hermit thrush. All again was peace.

". . .pushing relentlessly through our thick screen of pines was a large white star on a huge black face. . ."



The sunlight makes shadow pictures for the watcher by the pond.

Pond Shadows

By LORUS J. AND MARGERY MILNE

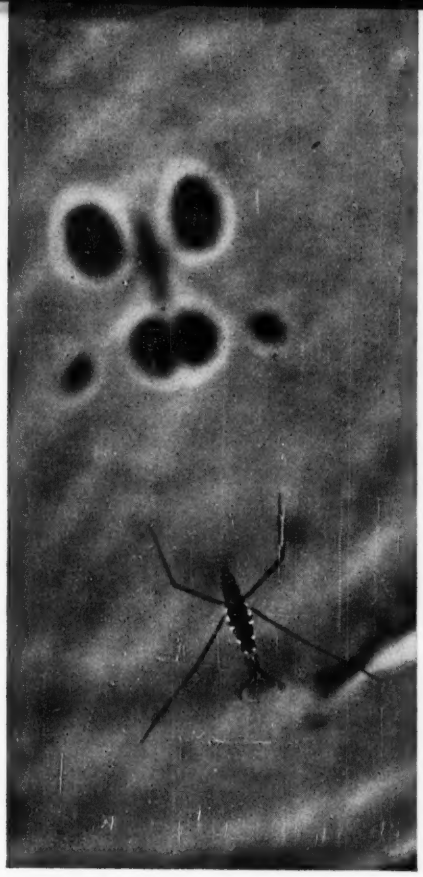
Photographs by the Authors

For the man on the mountain, the shifting pattern of shadows cast on earth by scudding clouds is an ever-changing checker-board. The watcher by the quiet pond is not always aware of what he misses. For him the sun is either hot upon his back and the water surface sparkles, or one cloud, then another bring shade and chill. Yet the sunlight makes shadow pictures, too, for the watcher by the pond. They glide across the sandy bottom, each one the silhouette of action in a world a few inches deep.

Here are six shadows that drift together. The hair-booted feet of a leggy bug press the water's face into dimples, each a crease that shows the insect's weight. The water cannot wet the hair boots, and the strider stands dry shod on his pontoons, his silver belly well above the surface. It is the six dimples that cast their shadows upon the bottom for all who look to see.

Suddenly the six shadows cease their drifting. A curious antic gives the insect forward motion. Its body lunges; the dimples jerk astern, and gained momentum carries the strider on its way. Its hair-booted feet slide over the water film; six shadows on the bottom follow every move. A short backward flick of two long legs, a pause for insect coasting, another jerk, another rest — like a skier gliding over snow between pole thrusts. In Canada the children know the insect as a "skater," but in warmer Texas the "Jesus bug" walks its way, suggesting only *Bible* scenes.

To the strider, the water's face is dry, a slippery, stretchy roof above a realm beyond his reach. Unknowable denizens of this underworld live out their lives and die. Only a fragment now and then floats upward to rest against the surface. These are morsels the strider seeks. A slender beak withdraws from be-



tween his short front legs and presses downward through the water's skin to reach the food and drink below. And thus the insect feeds.

Sometimes the strider chances on a whorl of long dry hairs spread out upon the surface, around a tiny hole. An insect in the liquid realm has swum or floated upward to its roof and punctured this to open out a guarding fringe around its breathing pore, there to inhale deeply if undisturbed. The single passage through the surface film is gone again when the pore is closed and hairs fold up together, the creature on its way, to reappear in another place when out of breath. The farmer's son has seen mosquito wrigglers do this trick in rain-filled barrels, supported at the water's face while drinking in the air they need. The beetles, too, which swim through ponds and streams, must thus restock the storage vaults beneath their horny wings, vaults of air bubbles to sustain the lifestuff of these midget submarines.

Flat sole expanded, pulsing in slow wavelets rolling fore to aft, a snail is creeping on the water's face, but upside down, upon the ceiling of its world. It, too, needs air, and from the water cannot get enough. The snail spreads out a gaping hole near where its shell conceals the coil of body next its foot, and having taken on its gassy load, must creep down stems to reach its leafy food, for buoyancy was added with the air inhaled.

Green flakes of duckweed float upon the water film, with trailing rootlets, waxy blooms, the smallest of our flowering plants. Upon the duckweed's glossy green, hop tiny insects whose short plump selves stretch less than thirty-seconds of an inch. It matters not if these gray motes fall on the weed or in the water, they do not break its calm. Yet leaping off to join their mates, they push a dimple in the surface film and cast a fleeting shadow on the bottom of the pond. To throw their

Above, dimples in the water film pressed down by the strider's hair-booted feet cast dark shadows on the sand below. Each spot is ringed by an edge of brightness. Often the pattern on the bottom is more conspicuous than the rowing bug above. Below, two striders approach the cast skin of a Dolomedes spider. One strider carries an ant around on its slender beak while removing the nourishing juices. Only the under surfaces of the ant and the spider's "ghost" are wet.

bodies through the air these acrobats have an odd device upon their undersides. It is a catch that holds the tip of curved posterior ends. With tip of tail securely tucked into the notch, the insect strains to straighten out, then slips the catch and the hair-fringed body smacks the water, throwing high the springtail insect's all. Only the sudden pat of thumping tail disturbs the surface of the pond.

Unwary treaders of the water's face are meat for spiders, whose eight long legs are booted like the water strider's feet. These spiders rove across the pond and take their food wherever chance leaves useful insects in their way. At home on land or surface film, the water-spider mother lays all her eggs in one silk sphere and drags this lightly after her by hindmost legs. Over the water go the pair; the mother and her precious ball. At times a fish snaps up the whole, a deadly risk the spider parent runs as part of life for self and young.

Into a quiet baylet of the pond dashes a fleet of beetles, each milling, spinning, through its boisterous crowd and setting up a zigzag wake of waves. Black bodied, smooth and strong, these insects lead a dual life. Their social whirl is all atop the water's face, although paddle feet push through the film to drive the beetles at their furious rate. The eyes of these, the whirligigs, are cut into an upper half for sight in air, and lower part to see the details of the water's depth. If food is below, or surface tactics do not fend off danger, down dive the beetles to swim or hide on the bottom.

The whirligigs are gone again. They hurried off as quickly as they came. The waves they made soon spend themselves in little lappings at the shore. The spring-tails hop from duckweed leaves and snails come up for air. The striders venture forth once more and little shadows wink and slide as sunshine spreads its light across the bottom sand. The pond is bright again.

This male umbrella bird from the forests of Costa Rica was photographed at the New York Zoological Park, Bronx, New York. He shows his fine, parasol-like head feathers. His mate is drab in color and lacks this conspicuous adornment.

The Strange Umbrella Bird

By GRACE V. SHARRITT

UMBRELLA birds are native to Central and South America and the Latin name of the genus, *Cephalopterus*, is descriptive of the male's amazing crest of handsome black feathers. This crest forms a parasol-effect, and the feathers radiate about four inches in diameter around the bird's entire head, hence the name, umbrella bird.

The male's adornment is another instance in which Nature bestows glamor upon the boys of the family while passing up the girls. But there is a good biological reason for this seeming slight to the feminine gender.

Nests of fledglings need careful protection from predators. Who hatches these fledglings? Not the male, surely! He with his black top-hat would be a fine target for any enemy. But the mother bird has been well camouflaged by wise Nature in a drab coat and no bonnet, so that, as she broods her eggs and later her babies, the nest gets a minimum of attention from robbers.

As for the male umbrella bird, a red rose pinned to his top knot and some junk jewelry strung around his neck would qualify him for prominent place in the Easter parade.

The sun at midnight over the Lofoten Islands off Norway's coast.

Arctic Summer

By GRACE E. BARSTOW MURPHY

A HUGE sign in four languages announced "Arctic Circle." Big stones, appropriately painted white, stretched into the distance in a wide curve. Our Swedish train under its electric wires tore by the town named "Polcirkeln," and did not stop.

"Wake up, Bob," I called to my napping husband, "you must not miss the Arctic Circle."

Still half asleep, he mumbled as he came to the window:

"I haven't my hat and mittens on."

But it was not cold. The comfortable train was warm. It was pleasantly cool — not cold — whenever we got out at the stations. I was keyed to my first experience of the Arctic midnight, now only a few slow hours ahead.

We had left Uppsala, Sweden, the evening before, following the thrilling meetings, June, 1950, of the Tenth International Ornithological Congress. In the Swedish light night we sped through apparently endless forests of straight tall spruce and white birch. As we traveled north, the trees became ever shorter and smaller. The diminishing size of the forest trees over the near-thousand miles of our twenty-three hour trip was both startling and dramatic. It was like a line of children standing in steps from the tallest down to the littlest. The dominant kinds of trees, spruce and birch, and the endless reaches of forests remained exactly the same, but the forests of the north were as if one had reversed the telescope when looking at the forests nearer Uppsala.

The roaring Abiskojokk, rushing down from the melting snows to the largest lake in Lapland — Torneträsk.

It was good ecological training in the effect of sun and warmth on the ability to grow. For at Abisko, our objective, we were in the land of the midnight sun, where the only summer day is of six weeks duration. In those short six weeks lies the growing season of the Arctic vegetation. We were amazed to find it as lush as it is. The fresh young leaves of the birches were half opened and light green, as lovely as in early April at home. Wild

Ornithologists Roger Tory Peterson and W. E. Clyde Todd. The latter was armored against mosquitoes, but did not need this protection for there were no mosquitoes.

flowers of various hues were blooming on every side, looking as New England looks two months earlier than the sudden Arctic blooming. I thought I saw anemones from the train.

There were lakes and marshes all day long, with hardly any waterfowl. It seemed strange in such a wilderness to see wide water stretches with no duck or grebe. We passed through pretty, red, Swedish towns, tidy and trim and charming as is the Swedish way. Between the towns there were almost no habitations — forest and lake and marsh; marsh and lake and forest. The country was low and rolling nearly all the way. At the city of Gallivare, there were hills with a little snow. Beyond, there was snow now and then beside the railroad, or along the edges of lakes.

Lapps in native costumes stood on the platform at Kiruna, the city that is the center of the iron mines of Lapland. We made friends with an old Lapp with a hook nose and a smile that grew warm and friendly under his curiosity. I passed him my cigarettes. He took one and when I held up two fingers, he shyly but eagerly took a second one, repeating my word — "American" — with a touch of awe. He was dressed in a blouse trimmed with bands of yellow, red and green. A leather belt four inches wide gathered it in below his stomach. A cap of equal gaiety had a red pompon on it as big as the old Lapp's head. His tight pants were tucked into his high, rough boots.

The mining operations in Lapland have changed the habits of the people. They no longer live in conical sod huts. Instead, they have small houses. One sees the old huts here and there, now used, I believe, for storage.

At Kiruna we were passing through taiga country, as the Russians call the halfway kind of vegetation between the forests and the bleak Arctic, treeless tundra.

We had crossed dozens of rivers. Those in the southern part of our trip were often full of logs. Swedish logging is done with method and care.

"I'll bet there are salmon in those rivers," said Bob.

Deeper inside the Circle, the rivers ran more madly, mostly white water rushing. The glassed-in dining car gave us the landscape well on either side of the train, as we ate good Swedish meals for less than two dollars apiece a day. Flowering plants hung the length of the car. In our little compartment with its convenient gadgets, dark curtains shut out the permanent day for moments when we could tear ourselves away for sleeping. We joked the jokes that must always be made up there: "Are you hurrying to finish your notes before dark?" or "I simply will not get up before sunrise."

The Swedish stations were neat and well-kept, with lawns, flagstones, and trees that were well grown from

The party of naturalists watches reindeer on the heights.

Norwegian Boy Scouts make music on their way from their Arctic homes to visit Oslo.

the care they had received.

We came to the largest lake in Lapland, Torneträsk. Mountains, impressive although not high, were rising out of its cold-looking, gray waters. We were fourteen hundred and more kilometers from Stockholm and 393 meters above sea-level. I felt somewhat overpowered at the bleak atmosphere of the place, as I had once felt in the sub-Antarctic.

Although there is a little town at Abisko Östra, there is only a camp at Abisko Turiststation, where we got off the train at eight o'clock, with the sun high in the western sky. We were led through wood paths to a tight little cabin on the hill just over the lake. A couple of score of our Congress friends from a dozen countries were finishing coffee, as Bob and I joined them. A young Swede, Sundevall, of Uppsala, our leader, who looked like a tall young Lincoln, suggested a walk. Hunting wild flowers and watching birds at ten in the evening was a new experience. But the sun was really my only thought. It still was high, partly hidden by clouds, shifting slowly towards the north.

I stood on the black sands of the lake, which is completely surrounded by snow-covered ranges. On the west, a strange-shaped semi-circular cut in the hills is named the Lapp Pass. Lapps migrated through it to Sweden. I worried over the clouds, fearing to miss the experience of the non-setting sun. Dr. Kramer, authority on migrations of birds, brought me a small purple flower about three inches high — *Rhododendron lapponicum.*

We walked back to the camp. The Chalifs of New Jersey had us come to their cabin for instant coffee, chocolate, crackers and apples, but I could not keep my eyes from the sun.

I sat alone on a rock near the lake in the cold, writing home to my children at midnight outdoors. The sun had dropped near the snows on the mountains. I watched it creep from the west of north to the north, to the east of the north. Its level of motion seemed constant. Heavy clouds hid it at times, dulling the colors I saw later at sea. But out from the clouds the edge of the sun came into sight. Sunrise light shone above it. Pink lines edged the clouds. Bright gold spread out in a long narrow line. Pink increased on the snow ridge, part of a beautiful sunrise of a sun which had not set. The lights were reflected in lake water below me. The far shores of the lake were in the shadows of mountains.

Above the snow, above the clouds, in brightest gold, the sun rose, its golden path falling across the water to my feet.

Clouds had added a mystery to the two-hour cycle.

I drew the dark shades in our cabin for sleeping.

Before the next midnight we took a spring tramp, climbing

The famous Lapp Pass, a a glacier-gouged valley through which the reindeer nomads came on their route from Arctic Asia to Scandinavia.

a mountain to snow above tree line. The birches were clumped and no longer single. They grew smaller and smaller as we climbed on our way. Their companions, the spruces, had been left farther south. On the sides of the mountain, birch trunks were recumbent. I thought back to our trip to the Snares Islands, south of New Zealand, in the spring of December, 1947, below the equator. I have written of how tree-trunks were recumbent to withstand the pressure of gales in the winter. Here in the Arctic, I found the same thing, although Bob thinks that the pressure of snow, not of gales, has bent the trees in the North.

It was hot as we climbed. We carried our sweaters and the men mopped their foreheads. The air was as sweet as a June day in New England, the breezes as soft. The views were magnificent from the heights — the forest below, the lake with its free-floating ice, enclosed by snow mountains, and on our right, Lapp Valley, a perfect example of valley-gouging by glaciers.

"Bob, there are reindeer!" He was in a depression but climbed up to watch them moving slowly and grazing. They varied in color from fawn to dark brown. There was one small one. Antlers were in velvet.

The white birches were the keynote of the landscape, from the tall single ones in the southerly regions to the clumped species at the foot of the mountain, those with recumbent trunks, gnarled and crooked, farther up, and mere bushes of birches at tree line. Between them, grass grew in rough clumps, with ferns still unfolded.

Wherever the eye fell there were flowers. Buttercups were the most lavishly growing. Another yellow flower looked like *Ranunculus*, but was not. It was *Trollius europaeus*, called in Swedish smörboll, or butterball. A delightful flower, it looks like a small yellow pond lily, because its petals are formed in that way. I found countless numbers in bud, and a few in full bloom, taller than buttercups. A yellow violet was also fairly common. The little Lapp rhododendron grew everywhere, reminding one how various are the sizes of the same genera in different parts of the world.

But the flower I loved most was a white one, *Dregas acopetalla*, the mountain avens of Yorkshire in England. It grows in alkali soil in high places to 80° North in the Arctic, a rose-like white flower, its eight petals pointed, with a bright yellow centre. As we climbed, we found one or two blooming, then, later, larger groupings of the delicate blossom, which was an inch or more wide.

A pink "carpet flower," a saxifrage, took me back to New Zealand in thought. There most of the wild flowers are small and close to the ground.

Ground juniper was luxuriant in growth. Reindeer moss, really a lichen, covered the earth, so it seemed. The wild stream tumbling down the mountain wore caps of frozen spray at each of its falls. Near the top of our climb leaves were not out, although buds of the willows and bushes were swelling. Mr. Sundevall brought me pieces of quartz full of little dark crystals that were garnets.

There were few birds. We watched a ring ouzel flying. It is a thrush, unrelated to the dipper, or ouzel, we watched by the stream. Bob's list on the mountain includes hooded crow, merlin, great snipe, wood sandpiper, three-toed woodpecker, starling, willow warbler, brambling, meadow pipit. Someone else pointed out a red-throated pipit. At the base of our mountain in a hollow old birch, we saw the remains of a nest with some feathers, probably built by a crested tit.

When we turned to come down, Bob and I were alone, and plunged into the steepness without knowing the path, until we caught up with the others not far from a swamp filled with cowslips. I had been thinking how easily the reindeer had ambled over the places that made me be careful. Suppose one does force one's body a little, a drop of finality in sweet-smelling woods on a perfect June day could only be part of perfection. There would be no moments for whimsical worry over what one's children would do with one's grandmother's rosewood, carved long ago.

We crossed into Norway by train after supper, again having the experience of national boundaries where a line on the earth makes such difference in people, their way of life, their architecture, language, and currency. Yet no line makes any difference whatever to fundamental humanness. Whether a person is saying: "Tak," "Merci," or "Thank you," there is the same courtesy on the lips, or in the response to a child, or a thousand other human matters, good ones and bad ones.

Again I watched the sun creep along above snow peaks from west to east, this time from our bedroom window in Narvik. When it began to rise, and the rays came pouring into the room just after midnight, I drew our curtains and slept. But both of those evenings had clouds. The third was rainy and dark. The fourth one, at sea, was our last and was perfect.

At quarter to eleven the sun hung clear and bright, well above the horizon. There was a soft suggestion of color all over the sky — not real sunset colors, but reminders of them. A white quarter moon was clear in the west. A white haze edged the feet of the southerly arc of the great archipelago of the Lofoten Islands. Their jagged tops were soft gray against the clouds in the west. A few people near me on the open stern deck seemed quiet. The sky above was blue, but around the whole horizon were faint lavenders, greens, pinks.

The sun sent a gold path across the sea. Its rays were too bright for my eyes. Gulls flew at the stern as always. There were few clouds in the whole wide sky — just enough brushings of clouds for reflections of color tints, and just enough land rising far off from the sea to vary the line of the north and east horizons. Because the sun was over lower mountains than at Abisko and at Narvik, it seemed higher in the sky than it had seemed to me before. I followed its eastwarding by keeping track of the shape of the peaks over which it moved. I blinded myself with its brightness and went below for colored glasses. With them I could look directly at the clear-cut ball. (Continued on page 386)

Debunking the Angleworm

By CHAPMAN GRANT

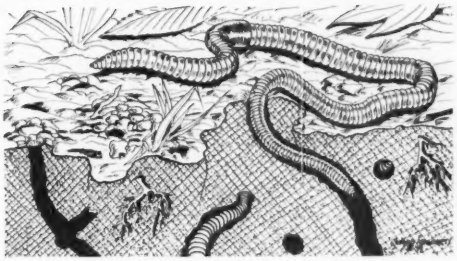
Illustrated by Romeo Mansueti

EXTRAVAGANT claims have recently been made about the value of the angleworm to agriculture. Some articles even stressed the possibility of hybridizing worms to serve "special purposes" and illustrated contrasting differences between plants grown with and without the aid of angleworms. Some of these articles were doubtless written in good faith, whereas others were plain Nature fakes — pictures and all. There may even be a clandestine connection between some "scientific" articles and the numerous advertisements by worm "farms," which sell this product to be "planted" in gardens to "fertilize" soil.

Specific claims of the angleworms' virtues are that they "fertilize" the soil; they "aerate" it; they make it more absorbent; they bring subsoil to the surface — an act resembling "plowing" — ; they "enhance the growth" of plants. Analysis of the facts may dispel some of the misstatements.

What is "fertility" of soil? Root hairs of plants absorb moisture and certain minerals, while above ground the foliage transpires gases. By the aid of sunlight and chlorophyll in green plants, the inert chemicals are synthesized into living matter. When the plant dies, or its leaves decay, the soil is "enriched" or "fertilized" only by the amount of the synthesized material that is returned to it. Return of vegetable matter to the soil may take years in the case of large logs, or a short period for lush vegetation.

With plenty of rain and sun, there is surprisingly little of the earth's surface that will not produce dense vegetation, whereas scant vegetation under optimum conditions denotes the presence of unfavorable minerals, such as salt, and not an absence of angleworms. If the accumulating plant tissues are removed by harvesting, erosion or fire, or are eaten by animals or insects, the soil will become impoverished. If it all remains to form humus, the soil becomes richer and richer. Complete return never occurs, since countless forms of animal and bacterial life prey upon plant life, releasing part of the synthesized energy back into the atmosphere.



Commercial fertilizers are used to replenish the minerals that have become depleted, or to furnish components that exist in *insufficiently available* amounts, or to add missing "trace elements." For example, when chickens consume a ton of feed, they generate heat and they liberate energy, which disappear. The by-product, manure, weighs a small fraction of the ton of food that they ate.

The size of the tract of land required to produce sufficient feed for a given flock of chickens for a year would illustrate the so-called "balance of Nature." It is obvious that the chickens consume, utilize and liberate into thin air most of the food energy they eat, and that only a fraction is returned to the soil, in the form of manure. The flock may be in balance with the productivity of the area this year, but there has been a depletion of the soil amounting to the difference between the amount of feed used and the amount of manure that is again convertible into plants. Therefore, the tract would sustain fewer and fewer chickens per year; i.e. a changing "balance" wherein the number of chickens supportable becomes smaller and smaller. The chickens have not enriched the land. They deplete it if their number is such as to consume *more* plant products than the plants in that area can synthesize, including the returned manure, of course. It would be more logical to refer to "feast or famine" than to an elusive "balance" in Nature.

An angleworm is a highly specialized animal. It cannot be cut up and regenerate the lost parts except to a limited extent; it cannot *eat* dirt; it cannot synthesize; it eats only organic matter that has been synthesized by sun and chlorophyll. How can an angleworm "enrich" the soil with any more success than the flock of chickens did? The angleworm has a great advantage over the chicken, in that it does not have to burn food to generate heat, but it does burn food in order to obtain the energy required in its body processes. To maintain a given number of worms in a given volume of earth will require replenishment of the food they eat. The worm must harvest plant tissue from the soil, and its droppings will contain less organic matter than the food it ate. Much energy has been dissipated.

The entire surface of the ocean is a garden of "plants"

minute, chlorophyll-bearing, unicellular "animals." These are the source of the synthesized energy that builds up practically all marine products. The big fish eats the smaller one that ate the invertebrate, that ate the plant, which contained the synthesized energy — no angleworms present. Vast stretches of underwater and surface water plants throughout the globe grow in profusion — and no angleworms. Parts of the swamps and flood plains of the Amazon, Ganges, Orinoco and Nile teem with vegetation — but no angleworms. Enormous areas are "desert" during part of the year, but "bloom" after rains — without angleworms. Giant redwoods, eucalyptus and forest trees in general are without surface roots, obtaining their minerals and water below the angleworm horizon, getting along nicely — without angleworms. Possibly it is not "cricket" to mention it, but the new and successful science and practice of "hydroponics", "soiless culture" or "nutriculture" has been built up and is being operated — without angleworms.

Did you ever dig angleworms for bait? If you did, you can remember that you had to look in *favorable places* for them. You never once thought that the worms created the favorableness of these places. You knew that behind the cow barn, in a spot that was moist from the run-off of a drinking trough, was the best place to get the worms. The worms did not bring the cows or the water, but multiplied in a favorable place and ate food that otherwise would have been available for plant growth.

The worm dealer gives instructions about feeding the worms. He knows that if you place worms in soil lacking in organic matter they will starve to death. They cannot eat dirt or enrich the soil, but they undoubtedly can *hasten* decomposition of available vegetable matter, making the fraction that they do not dissipate more *immediately* usable by plants. In an orchard, where the time element is not so vital, the presence of angleworms is a distinct loss in fertility.

Photographs that show plants growing luxuriantly *with* worms, contrasted to stunted plants said to be free of worms, may be genuine, but the difference is due to the short duration of the experiment. If the test had lasted long enough for the dead vegetable matter to form mulch without angleworms, the result would show little difference, except from the added growth during the early part of the experiment. The expense of introducing angleworms put into commercial fertilizer would show better results. If organic fertilizer — animal manure — is introduced into angleworm-infested soil, a part of it will be consumed by the worms and thus lost to the plants.

The second virtue claimed for the angleworm is that of "aerating" the soil. In the first place, do plants use "air" through their deep roots? Oxygen needed by roots is obtained through surface roots. Has any experimenter ever found a greater amount of any gas in angleworm-infested soil than in non-infested soil? Did you ever see an open angleworm hole? If you were to run wires into soil and pull them out, leaving small holes, would this process hasten the "aeration" of the soil? It is doubtful, because it is even difficult to get fresh air into a room without cross ventilation, much less into an angleworm burrow. The proportions of the different gases in the soil adjust themselves to approximately their proportion in the air above that soil, by the simple process of diffusion. Do angleworm holes help or hasten the drying of soil? If they did, they would be more often a detriment than a help, because more people are irrigating than draining their soil. Do angleworms help to drain soil? This virtue has not been claimed for them, but it would help, both for water storage in dry land and drainage in wet land. The angleworm cannot live in very wet soil, so there is no possibility of its aiding in lowering the water table. It has been stated, but not proved, that angleworm holes help absorb rainfall. It is doubtful whether an appreciable number of worms exist on an upland watershed. Their burrows occur largely in rich bottomland that does not need absorption. It has been stated that angleworms "sweeten" the soil. If soil is "sour," actually *acid*, neither angleworms nor aeration will correct the situation. To neutralize acidity, use lime.

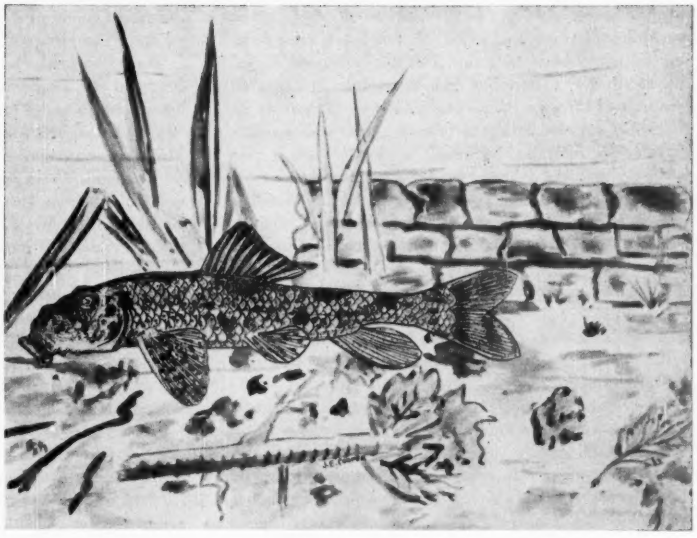
Angleworms are of value as bait, but their value to plant growing has never been proved. Facts point to their being, to some degree, an active enemy of plants.

Fanfare

By MAYBELLE TAYLOR

Tell me, little trumpet flower,
Do unseen fingers hold you tight
Against small lips I do not see?
Does some wee herald blow small blasts
Assembling tiny folk to state affairs
  By your fanfares?

All silent to my ears attuned so low,
Do you not tell the fairies when to come
  By trumpet show?



The hog sucker is a strange-looking fish with an abnormally large head, concave skull and exaggerated and flabby lips that hang from the under surface of the head and look like an attachment for a vacuum-cleaner. It pushes about objects on the bottoms of clear and rapid streams in seeking its principal food of insect larvae. A first look at the creature suggests that Nature is playing a joke.

Introducing the Hog Sucker

By JOHN E. COOPER

For several years I have practised my angling techniques, poor though they be, in one of Maryland's large, freshwater streams. Many times during this period I have been puzzled by a queer-looking fish that I now know to be *Hypentelium nigricans*, the black-horse or hog sucker. I had frequently observed schools of hog suckers, without knowing what they were, lying on rock beds, or in shallow riffles of the swift stream, and had occasionally seen individuals flitting back and forth in the knee-deep waters.

One day I was fishing in Baltimore's beautiful Woodlawn Cemetery, under a small bridge spanning Gwynn's Falls, when I spotted a long, odd-looking, brown creature lying motionless in a slightly concave section of the rocky stream bed. I had considered myself rather well versed concerning the fishes of the Gwynn's Falls stream, but this creature resembled no other fish that I had ever seen there.

Baiting my hook with a large earthworm, I dangled it enticingly from the end of my nine-foot fly rod. After many fruitless moments, during which my quarry totally ignored the bait, I concluded that this particular sucker was not interested in a worm diet. A different strategy was needed, so, stripping the hook, I cast the tapered line again into the stream. The hook came to rest several feet from the creature's mouth and it was only after a dozen attempts that I had the fish in hand.

The first close look at the animal suggested that Nature was joking. The fish was eighteen inches in length. The abnormally large head and concave skull created the impression that, in its younger days, it might have been struck between the eyes with the end of a baseball bat. Added to this were the exaggerated, flabby lips, which hung extended from the under surface of the head, looking like an attachment for a vacuum-cleaner.

Besides these details of its formation, the hog sucker differs from the common white sucker, *Catostomus commersonii*, in that it has larger scales and is more colorful. *H. nigricans* is more or less olive in color, with sides of a brassy hue, and a white belly. The back is more brown than olive and is marked with dark, irregular cross-blotches, which grow faint in large individuals. The lower fins are dusky and reddish in color. Ten or eleven rays are present in the dorsal fin, and along the lateral line the scale rows vary in number from forty-six to fifty-five.

Although their alimentary structures are much alike, the hog sucker and the white sucker differ in feeding habits. The common sucker is probably predominantly a mollusk-eater, with teeth adapted for crushing and grinding, while its hog-nosed relative has finer and more strongly hooked teeth, which are better adapted for eating soft-bodied items like insect larvae. More than half the food of a series of hog-suckers examined in Illinois was *mayfly* larvae,,with an insignificant ratio of small bivalves present. In feeding, the hog sucker

pushes about objects on the bottom of the stream, sucking up the exposed slime and mold, and thus picking up many insect larvae. The fish seems developed physically for this method of securing food in the rapid sections of streams. The hog sucker shuns muddy or warm water, and is partial to swift, clear streams that have stony or rocky bottoms. Gwynn's Falls is just such a place, and a haven for these suckers.

On subsequent field trips, during the spring breeding season when the fishes run upstream to spawn, I have observed swarms of the hog-noses clustered on rock ledges in swift, shallow water in the stream. In 1920, Forbes and Richardson found, in Illinois, that it was "commonest in the smaller rivers and about half as abundant in creeks, although not wholly wanting in either the large rivers or in the glaciated lakes of northeastern Illinois."

The common or local names of *H. nigricans* are legion. Probably the most familiar are black sucker, hog sucker, and hogmolly, with black-horse and mud sucker also widely used. In some publications the name is listed as toter. It is also, for good reasons, often called the stoneroller, stonelugger, hammerhead, spotted sucker and crawl-a-bottom. The names niggerhead and bootleg sucker also are used to describe the species. DeKay, as early as 1842, speaking of the hog sucker in the Lake Erie region, says that it is "frequently called by the whimsical name of shoemaker, probably in allusion to its being something of the color of shoemaker's pitch."

The range of the hog sucker covers considerable territory in the East and mid-West. Hubbs and Lagler list its range as: "From Minnesota and Lake of the Woods through the entire Mississippi River and Lake Michigan drainages of Wisconsin, the Lower Peninsula of Michigan (from the White and Au Sable Rivers south), southern Ontario and New York; south to Georgia on the east side of the Appalachian Mountains, to the Tennessee River system of Georgia and Alabama, to the Gulf slope of Mississippi and to southwestern Arkansas and eastern Oklahoma." In the Alabama river system, we find *Hypentelium etowanum*.

The comparatively high degree of coloration of the fish, its slender body, and large pectoral fins give it the appearance of a large darter, and its active habits add to this illusion. Much like a darter, the hog sucker rests on its over-developed pectoral fins. Moving about in the water, groups of these suckers travel in the fashion of trained platoons.

I had often heard that *H. nigricans* is less tenacious of life than many other fish, especially other suckers. This I have found to be true.

In case anyone may chance to wonder what business I have writing of suckers, let me hasten to defend my right; I myself have been listed among the species.

★

As a rule we avoid plays on words with overtones of anthropomorphism. Below we make an exception for a little word and tree exercise that was worked up by the author for a party attended by a group of foresters. It went over well with that group, and so we pass it on here in the thought that it might be helpful elsewhere.

A Tree Story

By BEN M. HUEY

who asks how well you know your trees and shrubs and challenges you to fill in the blanks in the narrative below with the appropriate names of woody plants. The key is found on Page 386.

This is a story of three sisters, (1) , (2) , and (3) Wood who lived in (4) Springs, California. One day while down on the (5) they met three brothers, (6) , (7) , and (8) Nutt from (9) , Montana. These boys had won (10) in the war and now liked to fly airplanes (11) time, but this day they went to the (12) to (13) sights. They saw two of the girls, but one had swum (14) out of sight, giving them a scare for a moment. The boys agreed that all of the girls were dandy (15) and, sitting beneath an (16) , they thought they were under a (17) . The six made charming (18) — the girls with (19) red cheeks and the (20) young men.

Suddenly, they heard a noise on the water, and all started to (21) around, and whom did they see approaching in a (22) canoe but the (23) Mr. Wood, the girl's (24) . The girls referred to him as "Old (25) ." He was a (26) but otherwise (27) . He had a sallow complexion and his hair resembled the (28) of a camp fire.

The (29) reached for his shotgun and said, "You (30) tarry, I know you would not (31) ish my daughters."

The girls began to (32) as the boys moved to go. One did with a (33) his hand to her (34) and she said, "(35) always love me?"

He replied, "(36) know I will."

The other two said, "We will (37) (38) you."

The boys left the girls and the old (39) , but not before making a (40) (41) a movie next day.

As the boys left one said, "He surely is a funny old (42) and a (43) too".

"Yeah, even a (44) treat you better than that", said another.

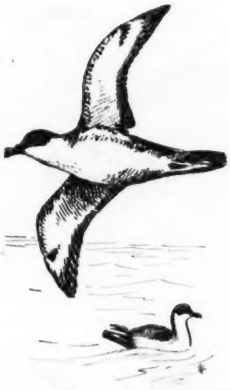
"A real (45) ", the last added finally as they walked out of sight.

Some Birds of the Sea

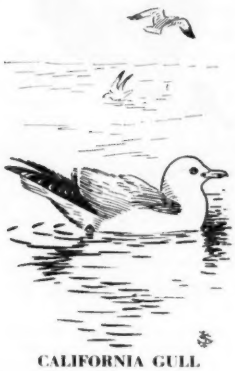
By E. LAURENCE PALMER

Illustrated by E. J. Sawyer

This is the sixty-second in NATURE MAGAZINE'S *series of educational inserts.*



GREATER SHEARWATER



CALIFORNIA GULL

BLACK PETREL

THERE are few things that I do professionally that I enjoy more than writing this general section of these special inserts. Here I can attempt to get others to share with me the experiences in life and in Nature that have given me the most pleasure. To do this, I must review those that have given me the most satisfaction and that, in any language or at any time, is fun. Sure, I like to gripe about politics, pigheadedness and penuriousness; about corruption, conceit and connivance; about dishonesty, distortion and deception; about injustices; about limits to opportunity, and about rewards for services given. But that sort of thing may leave one in a disgruntled frame of mind.

But when I think about birds of the sea — the subject of this insert — a world-wide series of pleasing pictures flashes before me. There is the memory of a half-mile row of gulls, all facing the same way into the wind, on a breakwater in Auckland, New Zealand. There is a recollection of a tangled mass of skuas, gulls, terns and their kin piling into a school of fish near Dunedin, New Zealand. There are pictures of gannets on rocks at the mouth of the St. Lawrence; scoters in flocks off the New England coast; files of pelicans following a wave in to the shore at Sanibel, Florida; white pelicans and California gulls pelting me and my students with refuse at Great Salt Lake in Utah. Then I see a high-flying osprey chasing an unfortunate gull near the "fish rocks" in the Gaspé area and another in the same act yesterday near Ithaca, New York; a petrel "walking" the raging sea ahead of a liner in the Pacific; a booby sailing over my head into the rays of a searchlight at Canton Island near the Equator one June midnight, a gull dropping mollusks on the sand and landing to get a meal before the animals could recover from the shock; a row of gulls and terns on a roof near a pier in the harbor at Seattle; a man-of-war bird pursuing a gull in Cuba; a kittiwake following a ferry near the Golden Gate; a golf course near my home covered with herring gulls; a flock of migrating gulls I once observed when I was a youngster on a hunting trip.

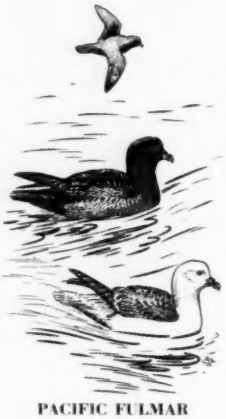
So on through my life, from year to year, from morning to night, and from the northern to the southern and the eastern to the western extremities of my globe trotting, I have acquired such memories. I could, I believe, write all the space allowed in this article and include nothing but specific and entrancing experiences with sea birds. I like the birds, and I like people who like them. This, I think, means that I like most people,

STORM PETREL

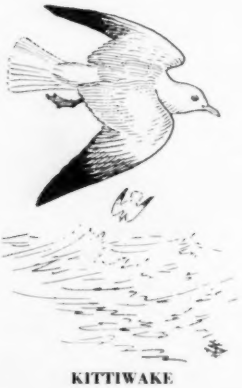
RED-BILLED TROPIC BIRD

BROWN PELICAN

BOOBY



PACIFIC FULMAR



KITTIWAKE

because I cannot see how anyone can be so insensitive to beauty as to fail to stare wide-mouthed at a gull as it seems, without effort, to sail into the wind, keeping pace with a liner whose standard is whipping violently in the breeze. I once caught one of my "science education" friends, who poohpoohs "Nature Study," admitting that one of the high spots in his recent vacation had been an experience with a colony of feeding gulls. This, I think, was the only evidence I have had that the gentleman was human, but from that point on, I realized that even he had a soul worth saving, and if terns and gulls in flight could not do it, then he most assuredly was hopeless.

There are those who preserve their impressions of sea birds by photographing them, by etching them, by sketching them, by painting them, or by writing about them. The dreams of my adolescent years were frequently haunted by those intriguingly and intentionally ghastly steel engravings by Gustave Doré of the unfortunate albatross in *The Rime of the Ancient Mariner.* I can still see, in my mind's eye, my first slow-motion pictures of some scoters that Arthur Newton Pack had photographed and shown me.

Probably the common terms "sea gull," "sea hawk" and "sea bird" cover as wide a variety of species as almost any common term, unless it be sparrow or warbler. At any rate, these are ordinarily meaningless because the differences in sea birds, sea gulls and sea hawks are so great. Nevertheless, there are generic attributes that may be applied with caution. The poets, who ordinarily are not careful observers, use great freedom here. Rupert Brooke in his "Pine-trees and the Sky," wishing to express wailing discontent, writes,

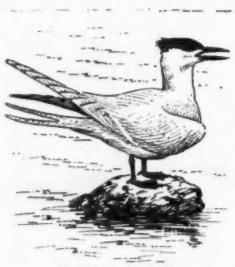
"I'd watched the sorrow of the evening sky,
And smelt the sea, and earth, and the warm clover,
And heard the waves, and the sea-gull's mocking cry."

I know of no one who has chosen the call of a sea bird to express happiness, although many find in the flight of these birds something to express exaltation.

Paull Hayden in his "Nantucket" most graphically uses a flying gull as the conclusive evidence that he has reached the sea in a walk from inland. He says;

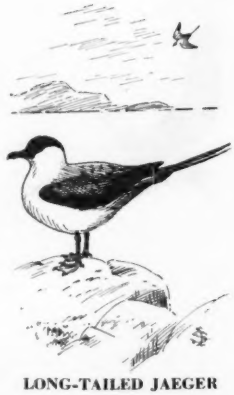
"Lo there — the rising of the last sand dune,
Its edge agleam with ribbon grass,
And keeping to the last its guard
Upon the view.
And there a gull — it *is* the sea — a white
Gull flashing through the sun
And whirling in an arc of faultless curve,
And then the sound — I think there *is* no sound
Like this — the everlasting boom of surf
Just here you reach the top —
Behind, the moors stretch back, gray still and free,
And overhead more sky than ever spanned
So small a spot,
And underfoot real sand,
And there, ahead,
Blue sea!"

Just think what that notably effective word picture,

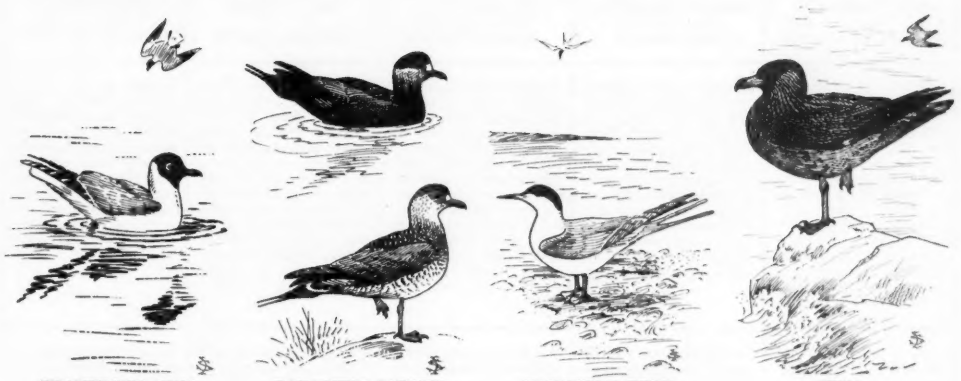


ROYAL TERN

POMERINE JAEGER



LONG-TAILED JAEGER



FRANKLIN'S GULL PARASITIC JAEGER FORSTER'S TERN SKUA

or any word picture of the sea, would be without a sea bird in it! With *The Bible* calling our attention to so many beautiful things in Nature, I find it difficult to explain why gulls and terns do not seem to be mentioned, and only pelicans of the birds here considered are rewarded by recognition there. Surely, the flight of a tern is such an exquisite performance that it should have been used as a simile for perfection by some of those who put *The Bible* into words. Some interpreters of *The Bible* tell us that the pelican referred to in *Leviticus* is the same bird as the cormorant referred to in *Isaiah*. Far be it from me to evaluate the ornithological training of those who lived so long ago, and whose writings are so infinitely less ephemeral than mine. There are, however, so many structural, behavioristic and other differences between cormorants and pelicans that I am compelled to believe that the writer of my *Bible* dictionary could not be considered as a critical ornithologist. It is quite possible that, in making this comment, I am myself too critical. I am quite sure that I am when I remember an educational movie film I once reviewed before its release by one of the major companies issuing such material. The fact that the film was called "Gulls," and showed few birds other than terns, worried me much more than it did the educational experts who approved it because of the excellence of its photography. My critical evaluation was not appreciated, whereupon I discontinued working with the group. Fortunately, I believe, they are no longer in the business, although a gull and a tern the world over may still be an unrivalled thing of beauty and a joy forever when in flight. When, ten years ago, I wrote a pamphlet on the finer side of life, I presented a picture of a tern in flight as my concept of one of the marvels of the natural world. As the years go on, I think that my enthusiasm for these birds will not be diminished in the least. I certainly hope not.

LEAST TERN

SURF SCOTER

That popular movie, "The Sea Hawk," of a few years ago, and Chekhov's four-act, far-fetched "comedy," *The Sea-Gull*," are examples of instances in which sea birds have gained recognition, at least in the titles of plays, although in neither case, I am sure, do the plays impress anyone as reliable interpreters of the role of gulls or jaegers in the general scheme of things. Surely, some of the implications in each case are rather far-fetched.

If we wish to consider sea birds as masters of their environment, we can find most interesting studies. The flightless penguins are masters of the sea itself. Albatrosses, some of the petrels, frigate birds, and some of the terns and gulls are equally skillful in using the air to get from place to place. Few of the birds have any ability to get about successfully on the ground, and some may be helpless there. In spite of this, I can well remember how successfully a penguin, with no ability to fly, and with legs only a few inches long, managed to keep a half-dozen, long-legged humans on the run to keep it from escaping into the sea one evening near Dunedin, New Zealand.

Since many of these birds get their food from the sea, it is not surprising that some of them have developed skill in catching fish and other animals beneath the surface of the water. Penguins, loons, scoters, and cormorants are past masters in this art. Pelicans and gannets are the leaders in diving from the air into the water. Gannets have been known to plunge from a height of nearly a hundred feet, and have been taken at a depth of ninety feet below the surface of the sea. Our little kingfishers of the inland waters can hardly compete (Continued on page 368)

NAME SCIENTIFIC NAME	GREATER SHEARWATER, HAG, HAGDON *Puffinus gravis*	FULMAR, NODDY, WHITE HAGDON *Fulmarus glacialis*	BLACK PETREL *Loomelania melania*	STORM PETREL *Hydrobates pelagicus*
DESCRIPTION	Length to 20 in. Wingspread to 45 in. Tail to 5¾ in. Bill to 2 in., curved downward at tip, dark yellow-green. Body cylindrical, slender. Wings curved and pointed. Black cap. Back grayish-brown with white patch at tail base. Breast and belly white. Bars on sides and flanks. Sexes alike.	Length to 20 in. Tail stubby, to 5 in. of 14 feathers, broad to rounded ends. Bill to 1-3/5 in., under-bill not turned down at end. Nasal tubes prominent. Dark phase almost uniformly smoky-gray. Light phase, with head, neck and under parts white, slaty gray above, with flanks lightly washed with gray. Sexes alike.	Length to over 9 in. Tail to 3¼ in., with fork to depth of 1 in. Bill to 3/5 in. Sooty black with no white on the rump, such as shows on Beal's petrel and some other petrels. Larger than the ashy or the Socorro petrels, which also appear to be all black. Black petrel has a lazy, bat-like flight.	Length to 5½ in. Tail 2½ in., square. Legs shorter than in Wilson's petrel and black, not projecting much, if any, beyond tail when bird is in flight. Sooty-black above. Under parts, browner. White at base of tail with some white, black-tipped feathers.
RANGE AND RELATIONSHIP	Entire Atlantic Ocean from Greenland and northern Europe to South Africa and southern South America. Arrives in northern part of range in May and June and leaves that range in October and November. Related sooty shearwater has all-dark body. Audubon's shearwater smaller, without tail-base patch. A dozen species.	Atlantic fulmar breeds northern Greenland to Cumberland Sound, wintering south to Massachusetts. Pacific fulmar breeds in islands of Bering Sea, the Pribilofs, the Kuriles and Commander islands. Winters south to Lower California and Japan.	Ranges from Marin County in California to southern Peru. Breeds on Los Coronados and San Benito islands and on some islands in the Gulf of California. It is probably the commonest of the black petrels to be seen off the California coast. It may breed in California, but there seems to be no record of it.	Ranges from coasts of northern Europe, Labrador, Newfoundland, Nova Scotia and Maine to Zanzibar. Breeds mostly on northern Atlantic islands, including Iceland, the Shetlands, the Faroes and the Orkneys, also on Malta in the Mediterranean and south to Madiera. Has been found in Greenland.
REPRODUCTION	Nest not described. Egg 1; white, pointed oval, without gloss, 3-1/5 by 1-9/10 in. Little known of nesting habits, incubation, but downy young are sooty-gray and immature birds have white areas washed with soot, and white collar almost complete. No authentic record of northern hemisphere breeding.	Breeds in large colonies on high cliffs. Nest none, or shallow, bare or grass-lined depression. Egg 1; 2.9 by 2 in., white, brittle, rough, chalky, musky. Incubation 50 to 60 days by both sexes. Downy young, with head and under parts white and blue-gray above. Immature usually like darker phase.	Nests in burrows, or between good-sized boulders where there is a degree of protection. It is possible that this larger petrel preempts the nest burrows of the smaller but associated Socorro petrel. Digs nest in April. Spends May at sea. Lays eggs in June. Rears young in July and migrates in August.	Nest in a burrow in the ground or under a rock, composed of fragments of grass or feathers. Eggs, one, 1 by 4/5 in., dull-white sometimes with an obscure dark wreath at the larger end. Incubation about 35 days. Young at first with sooty, ashy down.
HABITS AND ECOLOGY	Flaps and sails near surface, showing contrasting black and white of body. May run on water with rapid foot movement and half-opened wings. May rest lazily on water, but needs wind to take off quickly. Food largely small fishes and squids, or offal from fishing boats, sought in flocks.	Flies with stiffly held spread wings in long glides unlike the gulls, which flap wings more frequently. Call a chuckling cry. Food small fish, mollusks, garbage or any waste animal matter it may pick up, often eating so much it cannot take to the air. Follows ship, settling on water to eat garbage.	Rather solitary birds for the most part. Food is snatched from the surface of the sea during bat-like flight, or picked from the sea while the bird sits on the surface. May dive to a depth of a foot for food, but to reach this depth, must dive from a height in the air. May follow vessels far.	Young birds of the year are lighter than adults. Food, largely oily and fatty substances, including fish, shrimps, seaweeds, garbage, mollusks, all of which it vomits freely when captured. Known to feed on dead whales. Bodies may be so oily that they may be burned as lamps, with help of wick.
ECONOMIC IMPORTANCE	A scavenger and fish-eater. Used as bait by some fishermen. May be eaten and have been described as "not bad" if skin and fat is removed before cooking, and carcass is covered with bread crumbs and roasting is light rather than thorough. Has been caught on baited hooks.	Both birds, young and eggs have been gathered and made into a clear yellow fulmar oil, and the feathers have had a commercial value. One record indicates a harvest of 20,000 young in one month for production of oil. Has been taken on baited hooks. May feed in kelp beds, but more often in open water.	Interesting birds of probably little economic importance. Young birds are covered with a slate-colored down except for the chin, and this is not lost until the bird reaches practically full growth, the down remaining on the ends of the mature feathers.	Even in violent storms may fly at sea a foot or so above the waves, flying with or into the wind and being active at night as well as by day. When they pick up food from the water, they let down their feet and paddle, or merely pat the water while they hover.

RED-BILLED TROPIC BIRD, BO'S'N BIRD *Phaethon aethereus*	BROWN PELICAN *Pelecanus occidentalis*	BOOBY *Sula leucogaster*	PARASITIC JAEGER *Stercorarius parasiticus*	POMARINE JAEGER, GULL CHASER, JIDDY HAWK *Stercorarius pomarinus*
Length to 3 feet, of which about ½ is tail Wing about 12 in. Bill 2½ in., bright red as contrasted with yellow-billed species. Smaller than herring gull. Mostly white but with black patches on shoulders and extremely long central tail feathers. Iris black Sexes colored similarly.	Length to 54 inches. Wing-spread to 7 feet. Tail of 22 feathers, to 7 in. Bill to 12½ in. with throat pouch to 1 ft. long along neck. Smaller than white pelican and darker. Carries head hunched on shoulders in flight, with bill resting on breast. Sexes similar. Adults with yellow crown and breast patch.	Length to 31 in. Wing-spread over 4 ft. Tail 9½ in. Bill 4 in. Sexes alike. Dark brown above. Under wings, dark brown and white. Line contrast between dark breast and pure white belly. Contrast between belly and breast indistinct in young. Feet yellowish. Iris white. Bill light gray or flesh-colored.	Length to 21 in. Tail to 6 in. Longest tail feather to 9 in. Bill to 1½ in. A dark and light color phase. Sexes alike in each phase. Dark phase dark slate-brown, with under parts lighter and some straw-yellow on sides and back of neck. Light phase dark above, with breast and belly white.	Length to 23 in. Wing-spread to 4 ft. Tail about 5 in. with middle feathers projecting 1 in. more. Bill 1¾ in. Broad twisted central tail feathers different from those of other jaegers. Has broad breast band, barred under parts and scattered white on primaries, making indefinite band. Color variation high
Ranges through seas of tropical America Breeds in Lesser Antilles and from coast of Peru north to L. 26°. Ranges north to California accidentally, and has been seen on Newfoundland Banks spending most of time far from land over the sea. Favors hot, sunny islands surrounded by warm seas.	Breeds on South Atlantic and Gulf coasts of United States from South Carolina to Texas and south to Brazil and on Pacific coast from Galapagos to Colombia and Ecuador. Winters from Florida and Gulf coast southward. Occasionally north to Nova Scotia, Michigan and Wyoming.	White-bellied breeds Bahamas and West Indies to Brazil, winters in breeding range and to south. Blue-faced found southern Florida to Venezuela and Lower California to western Mexico and has white tail and black towards wing ends, as against whole back edge of wing black in white-bellied. Seen perched on buoys.	Breeds from northwestern Alaska to Greenland, Europe and Siberia south to northern Labrador or equivalent. Winters from southern California to Argentine, Cape of Good Hope, Australia and New Zealand and on our East coast from Florida to Straits of Magellan. Occasionally found in interior of North America.	Breeds from Banks, Somerset and Melville islands and central Greenland to northwest Alaska and northern Mackenzie, Iceland, Russia, Siberia and Norway on coasts. Winters south to Gulf of Mexico, Peru, South Africa and Australia. Sometimes found in inner North America, and common in fall on California coast.
Nests on the ground in a hole to 3 feet deep and to 18 in. across, on ground or even known in a tree. Egg, 1, 2¼ by 1-2/5 in., white, sprinkled or spotted with brownish-red. Nesting season may be at any time of the year. Incubation by both birds. Downy young a drab gray.	Breeds in great colonies, usually on islands. Nest on ground or in low bushes of grass or sticks. Eggs 2 to 3, 3 by 2-1/5 in., chalky-white. Incubation about 4 weeks by both parents. Young black and bare when hatched, but downy in 12 days. Flight feathers complete at 10 weeks.	Breeds in large colonies on islands in sea with no nest, or a crude nest on ground or in low shrubs, then of sticks. Eggs 2, 2½ by 1¾ in., chalky-white. Incubation by both parents in turn. Young naked at first but soon white-downed, then gray-brown when feathered, assuming adult plumage in second year.	Nests on shores of lakes, rivers or seas. Lined or unlined nest of grass on ground. Eggs, 2 to rarely 4, 2½ by 1½ in., olive-green to gray, marked with various colors. Incubation 24 days by both sexes. Young, sooty-brown down above, lighter beneath.	Nests on islands or on mainland, preferably in colonies. Nests crowded, but may be absent, or of some plant material. Eggs, 2 or 3, 2-4/5 by 1¾ in., variable olive-to greenish-brown, dark brown spotted with dark gray background patches. Incubation period and parental care not adequately described. Nesting time in June.
Immature birds lack long central tail feathers and have yellow instead of red bill. Food, fish and squids taken by diving into the sea. Call, a shrill clicking rattle. May soar high above most other birds or fly with short wing beats like those of pigeons, latter method the more common.	Flies by a series of flaps and sailings, often followed by a headlong plunge into the sea for food, or, in flocks, will follow wave crest to shore and fly out to another. Call, a rasping choking bark, but adults unusually quiet. Young noisy. Food largely small fish such as menhaden, which are not used as human food.	Birds are tame on nesting grounds. Catch food of squids and fishes by diving. Booby, of one species or another, widespread over tropical world with some in Atlantic, Pacific and Indian Oceans. Young feed by thrusting head down throat of a parent bird. Flight strong but interrupted by sailing.	Described as a sea-hawk that chases gulls and terns, shows white flash on wings, and tail pointed by central tail feathers which are pointed and to 9 in. long in parasitic and to 16 in. long in Long-tailed, and blunt in pomarine, and about equal in length to those of parasitic.	Powerful fliers capable of overtaking most other associated birds, forcing them to release their food. May catch and destroy other birds, usually smaller kinds. Particularly noticeable forcing gulls and terns to release garbage and fish wastes thrown from seagoing vessels.
May be found 600 miles from any land. Of little economic importance. Are unmolested by man-o-war birds, usually. May rest on the sea but may also come to light on mast of a vessel, usually attracting attention of passengers.	Economic status argued long and loudly with skilled scientists defending the bird. Even government agencies charged with food production defend the bird against prejudiced fishermen. Of 3427 fish taken from pelicans in Florida, only 27 were of any food value to man, none of high value. Related white pelican now threatened with extinction.	Value questioned by fishermen but defended largely by ornithologists. Eggs, young and adults are sometimes eaten by man. Greatest abundance is where fish of food value to them are most abundant. Interesting feature of environments in which found. Known to stray north to Cape Cod.	Feeds largely on fish most frequently taken from gulls and terns, except when extremely abundant. Feeds on young of birds in neighboring nests on nesting ground, and may eat mice, lemmings, ducklings. May well be considered as predatory on some valuable water and game birds. Notably agile on the wing.	Undoubtedly a predatory parasite. Known to destroy nests and young of water fowl. May feed on mice and lemmings, or may on occasion feed on carrion and garbage. May drive other birds from available food. Carries middle tail feathers in a vertical plane somewhat like a rudder.

NAME SCIENTIFIC NAME	LONG-TAILED JAEGER *Stercorarius longicaudus*	SKUA, SEA-HEN, SEA-HAWK *Catharacta skua*	CALIFORNIA GULL *Larus californicus*	FRANKLIN'S GULL *Larus pipixcan*
DESCRIPTION	Length to nearly 2 ft. Tail pointed, with central feathers to 16 in. long. Bill just over 1 in. With distinct black cap, pale back, broad white collar with yellow on sides of head. Legs and feet blue-gray with black webs as contrasted with black legs of parasitic jaeger. Two or 3 outer wing primaries white. Light and dark phases.	Length to 22 in. Like a chunky herring gull with square-cut, 6-in. tail, with conspicuous white patches at primary bases. General appearance like a hawk, soaring little but flying with incredible speed. Wings rounded at tips in flight rather than slender and pointed.	Length to 23 in. Tail 5-4/5 in. Bill 1-4/5 in. Pearl-gray back. Head, throat, neck and under parts white. Wing-tips mostly black. Feet greenish-gray. Large wedge-shaped white spot near wing-tip. In general, much like a small herring gull except for white spot near wing-tip. Sexes much alike. Tail brownish-black in grayish-brown young.	Length to 15 in. Wingspread to nearly 3 ft. Tail 4½ in. Bill 1¼ in. Head black in summer but white in fall and winter. A broad white band between gray of wings and black wing-tips. Laughing gull has more black and less white on wing primary feathers. Bill dark red with band of still darker red. Legs and feet dark red.
RANGE AND RELATIONSHIP	Breeds in Arctic Europe and Asia and from Alaska to Labrador and Greenland. Winters south to Florida, Gibraltar and Japan, and in migration found to Chile and Argentine. Occasionally found on Pacific coast south to California. May be found inland through much of the middle West and into Manitoba and British Columbia.	Breeds at mouth of Davis Strait, on southeastern Baffin Island, in Ireland, the Faroes, the Shetland and the Orkney islands. Breeding ground of southern subspecies not known. Winters Newfoundland to New York and Niagara River and Norway to Mediterranean with southern subspecies on to Chile and New Zealand.	Breeds from Great Slave Lake to Great Salt Lake and Stump Lake, North Dakota, to Mono Lake, California, and found in summer from Washington to southeastern Alaska. Winters from British Columbia to Utah and Texas, Lower California, Oaxaca, and has been found in Hawaii and Japan.	Breeds from southern Alberta and southern Saskatchewan to south-central Manitoba and Utah, South Dakota and Minnesota. Winters from Gulf coast of Louisiana and Texas to Peru, Patagonia and Chile. Often and relatively easily confused with laughing gull, being almost identical in young stages of the latter.
REPRODUCTION	Breeds in colonies on islands, laying eggs in a depression on the ground lined or not lined with leaves or moss. Usually 2 eggs, 2 in. by 1-9/10 in. incubated by both sexes 23 days. One annual brood. Downy young brown with paler head. Adult plumage assumed at two years.	Does not breed in colonies. Nest of grass and lichens on rocky cliffs. Eggs 2 or 3, 3 by 2½ in., olive to brown, with large and small brown markings and spots. Incubation by both sexes for 30 days and one annual brood. Downy young, buff or ruddy-gray and darker above. Adult plumage probably after one year.	Nests on the ground, making nest of a few feathers or plant parts. Eggs, 3 to rarely 4, highly variable, 2¼ by 1¾ in., laid in May and June, and one brood a year is the rule. For the first two years, the young are nondescript, mottled, grayish-brown and white. A black bar on the bill is the last juvenile character to remain.	Nests about lakes and marshes. Nest a mass of plant material on ground or even floating. Eggs 2 to 4, highly variable, 2 by 1½ in. Nest in late May and early June. Incubation to 20 days by both sexes. Downy young either dark brown above or mottled black above or gray. In nesting area, adults may care for young of other gulls.
HABITS AND ECOLOGY	Highly varied calls of "pheu" and "krr" or "kri." A most powerful flier, being superior even to a gyrfalcon that might be tempted to attack young. Food varied, including garbage, any animal food, insects and even berries, but like their relatives, they will rob other birds, or even kill them. Literally a sea-hawk.	Spends much of time in flight at sea robbing other birds of their food at will. In defense of young it can drive off dogs and may attack sheep, thus raising the ire of shepherds. Differs from closely related jaegers in blunter tail, chunkier build and the broad white wing patch at primary bases.	Superior fliers, going apparently at will without effort and going into a strong wind without apparent wing motion. Food, wastes, insects, mice. It is believed that this is the gull that saved the Mormons from starvation when they were threatened with a plague of crickets, for which act the Mormons erected a commemmorative monument.	Food, fish, frogs, crayfish, mollusks, insects gleaned from cultivated fields, particularly grasshoppers. Ranges over a wider area of the interior of the continent, but there is but one authentic New England record. Fall and spring migrations reverse each other. Call, a soft clucking sound or a plaintive noise with some musical sounds.
ECONOMIC IMPORTANCE	Probably destructive of eggs and young of birds that share its nesting grounds, and may destroy young and eggs of waterfowl in this way. However, they have become such superior masters of the air that it is hoped that they may never be completely destroyed. Not ordinarily a common bird.	A sea hawk, and as such a destroyer of other birds. May be serious pest in nesting grounds of waterfowl. May effectively attack birds much larger than itself, taking eggs or killing young that may be helpless under the circumstances. An aggressive individualist if there ever was one.	Scavengers and active agents in controlling possible epidemics of insects and other pests. The birds are admired for their flight and beauty generally, and appreciated because of their food habits. Much like a ring billed gull with gray-green legs, but with a red or red and black spot on lower bill, instead of black ring.	Undoubtedly useful as a scavenger and as a destroyer of injurious insects that attack our agricultural crops. This habit is particularly pronounced in the breeding area, which happens also to be a region of good agricultural productive capacity.

KITTIWAKE, SNOW GULL, WINTER BIRD *Rissa tridactyla*	FORSTER'S TERN *Sterna forsteri*	LEAST TERN *Sterna albifrons*	ROYAL TERN *Thalasseus maximus*	SURF SCOTER *Melanitta perspicillata*
Length to 18 in. Wingspread to 3 ft. Tail to 5¾ in., slightly forked. Bill to 1½ in., yellow. Like a small ring-billed or herring gull but with black legs and solid black wing-tips. Feet with but 3 toes. Wings appear to be proportionately longer than those of the herring gull. Sexes colored alike but immature as suggested below. Head streaked in winter.	Length to 15 in. Wingspread to 30 in. Forked tail to 8 in., fork being to 5 in. deep. Bill to 1¾ in., orange yellow at base and black towards tip. Black cap in breeding season absent in fall and winter, when bill is black. Pale gray on back of wings and nearly white beneath.	Length to 9¾ in. Wingspread to 20 in. Tail about 3½ in. with 1¾ in. fork. Bill about 1 in. Female smaller than male. In summer shows white patch on forehead, sharply contrasting with black of cap. Unlike young black tern, has dark line rather than light line around wing band.	Length to 21 in. Wingspread to 44 in. Tail to 8 in. with 4 in. fork. Bill to 2⅛ in., orange-red with black tip or yellow-range with black tip as against bright red bill of Caspian tern. May show solid black cap or have white on forehead with back head feathers suggesting a crest.	Length to 22 in. Wingspread to 3 ft. Tail to 3½ in. Bill to 2½ in. Weight to 2 lbs. 6 oz., with female slightly smaller. Drake black with one or two black "skunk" markings on crown. Duck brown with 2 often obscure light patches on side of the face. Young birds have conspicuous light patches.
Breeds from eastern Arctic islands to Baffin Bay and Gulf of St. Lawrence. In Europe from Arctic islands to France. Pacific form breeds from Bering Sea to Kamchatka. Winters south to the Canaries, Azores, Mediterranean, and on our West coast on to Lower California. It is essentially a bird of the open seas.	Breeds from interior of California, southern Oregon and Washington, Utah and Nevada and Manitoba south to Colorado, Nebraska, Minnesota, Illinois, Texas, Louisiana and Virginia. Winters central California, Gulf of Mexico coast, South Carolina to Guatemala and Brazil.	Breeds along Atlantic and Gulf coasts from Massachusetts to Texas and on islands in the Mississippi and Missouri rivers into Iowa, South Dakota, Kansas and Nebraska. Winters from Louisiana to Argentine and on east coast of Africa. Sometimes found in Ontario and Nova Scotia.	Breeds in Bahamas and south Atlantic or along Atlantic and Gulf Coast from Virginia to Texas or on Pacific coast of Lower California and Mexico. Found north to Massachusetts and San Francisco. Winters from California to Louisiana, Florida and Bahamas south to Brazil, Peru and Argentine.	Breeds from northern Alaska and Greenland south to Gulf of St. Lawrence, James Bay, northern Manitoba, northern Saskatchewan and Alberta. Winters from Bay of Fundy to Florida and from Aleutian Islands to Lower California and in interior to Great Lakes, British Columbia and even to Louisiana.
Nests in colonies on rocks of islands, or on cliffs overhanging the sea. Primitive nesting habit. Eggs, 1 to rarely 4, 2 2/5 by 1-3/5 in. Nest in May and June. One annual brood. Incubation 26 days. Downy young white with yellowish back, rumps and thighs, not spotted like young herring gulls.	Nests in colonies. Nests little to nothing, or well made on ground, on floating material on muskrat houses. Eggs, 2 to 5, 1-4/5 by 1-1/3 in., variable, olive or gray, chocolate marked. Incubation by both sexes, 23 days. One annual brood. Downy young pinkish-brown and lighter beneath, spotted above.	Nests usually in colonies on beaches, sand-flats, or exposed bars in rivers and harbors. Nest a mere hollow in sand. Eggs, 2 to 4, 1.3 by 1 in., from clear pale-green or olive to dull drab and spotted in lavender and brown. Incubation, 14 to 16 days and one or two annual broods.	Breeds in colonies on sandy islands or bars. Nest a hollow in sand. Eggs, 1 to 4, 2.7 by 1.7 in., white to ivory to dull yellow, marked in gray or black or dark brown or unspotted. Young birds mostly white above with creamy tinge with gray primaries edged with white.	Nest on ground, often on islands and near water, usually under grass or bush. Eggs, 5 to 9, 2½ by 1¾ in., pale buff to creamy in color. Nesting time June or July. One annual brood. Incubation and care of young by female. Young and old lack the white wing-patches of white-winged scoter.
Not commonly seen on or near shore, spending much time in flight over oceans, hundreds of miles from land. May alight on ships at sea only to be chased from there by some more aggressive sea bird. Immature has conspicuous black band across wings and dark streaks on sides of neck.	Birds 10 months old resemble parents closely. Closely resembles common tern, but has silvery rather than dusky region on primaries from above, and darker tail. Feeds rather largely on insects caught on the wing or may eat frogs, fish or other available aquatic animals.	Food is largely small fish, insects and small invertebrate animals, including shrimps. It has many enemies, including crows, cats, skunks and some other predators. They vary considerably in abundance from year to year, but are worthy of protection for their beauty at least.	Food almost exclusively fishes up to 4 in. long, captured by plunging from considerable height after a fluttering hovering. Poor swimmers, though feet are webbed. When traveling they fly in lines or in calm weather may fly at great heights with strong wing beats.	Food, like that of other scoters, chiefly mussels, clams, scallops, crayfish and a small amount of plant material, which may be taken into the body incidentally. Small stones are also frequently found inconsiderable numbers in the crops of the birds. Rises heavily from surface and has sustained flight.
Have been caught on baited hooks dropped from speeding boat on which there may be a strong interest in the bird. May follow ships clear across the ocean, living on wastes dropped overboard. Individual birds have been taken on both sides of the Atlantic.	Undoubtedly useful and unquestionably a marvel of flight and sheer beauty. Call is a harsh, grating, low "tza-a-ap, zreep, zrurr" as contrasted with common tern's "tee-ar-r" and a vibrating "tut-tut" or "kit-kit," or a piercing screaming "tear."	Formerly the birds were used for hat decoration, a practice which has most fortunately been outlawed, with obviously improved appearance of the fair sex and better chances of survival for the terns. No dead bird on a hat accompanied by any woman can rival in beauty a live least tern on a mud flat.	Undoubtedly a harmless, beautiful bird, a master in flight and with courage enough to steal fish from pelicans. Inland it is observed principally in the winter months. Ordinarily it is considered a bird of harbors and shoals near bays.	Generally considered as inedible, particularly if allowed to "hang" with the viscera not removed. Some assert from experience that the immature birds are edible. Destruction of small unmarketable shell-fish may be considerable, but hardly of serious economic importance to man at any time.

(Continued from page 363)

in such company. Some birds, like the frigate birds, the jaegers, the ospreys and the eagles find it simpler to steal their food from other birds that have captured it by more orthodox means. This act is one well worth watching by those who are satisfied only by supreme excellence in any skill.

Of course, anyone knows that many of our sea birds get their food simply by setting themselves down on the surface of the sea and feeding on something floating at the surface. The gulls and some of the terns do this, but even these birds seem often to find it more convenient to pick up a lunch while remaining in flight close to the water's surface. The petrels which seem to walk the wave, even in the roughest weather, are undoubtedly able to survive without any spectacular high dives, difficult plunges or long-distance swimming under water.

It is not surprising that, with these varied behaviors of sea birds, there should be significant variations in structure. A frigate bird with an 8-foot wing-spread and a body the size of that of a red-tailed hawk obviously has advantages in flight not possessed by a heavy-bodied short-winged penguin. It is not surprising that the greatest globe trotter of all animals, the Arctic tern, which each year makes a return trip from the Arctic Circle to the Antarctic Circle, should be among the sea birds with which we are here concerned. It is quite possible, however, that they do not cover more miles in a year than some other sea birds that spend endless hours on the wing in more restricted geographical areas. Who is to measure the mileage of an albatross, of a frigate bird, or even of some of the more slowly moving petrels?

If we find variations in the wings of our sea birds, it is similarly appropriate that we find differences in their bills. Much fun has been made in ribald rhyme of the eminently practical pouch beneath the lower bill of a pelican. It is doubtful if this is any more practical than the breathing tubes close to the upper beak of the petrels, which must face repeated duckings, or the hooked beaks of the jaegers, which must be able to overawe the birds from which they steal their food.

The reproductive story of these birds is full of surprises. Some build no nests. Others build crude nests in trees, using sticks and adding a few more sticks to the structure each year. Still others make no nest at all, sheltering the eggs, as do the penguins, with their own bodies. A few dig rather deep burrows in the sand, or even in more solid earth, but these details are to be found in the charts in this insert or in other earlier inserts considering these birds.

The number of young varies, as it should, with the hazards that must be faced by the species involved. Many extensive studies have been made on the behavior of young and old birds in colonies, or where they live solitary lives. The question of whether there is advantage in the colonial habit will find supporters and critics. Certainly, the standard popular phrase "dead as a dodo" refers to the failure of a colonial species to survive against the attacks of its enemies. While sailors might well leave their ships to go ashore and collect eggs for food, or young for their oil where there are extensive colonies, it is doubtful if this would be profitable if the nesting birds were not concentrated in restricted areas.

It is only natural that birds like the scoters, whose enemies are many, and where but one parent assumes responsibility for the young, and whose defense of their nest and young is rather futile, should have more eggs than would be necessary with penguins, some of the petrels or even the gulls, where parental care is shifted from one parent to the other, but is continuous so far as the eggs or young are concerned. It may be significant that many of our sea birds nest on small islands surrounded by violent seas. Whether this has always been the case, or whether it simply means that birds with this habit have survived propinquity with man while others have disappeared, I am not prepared to say.

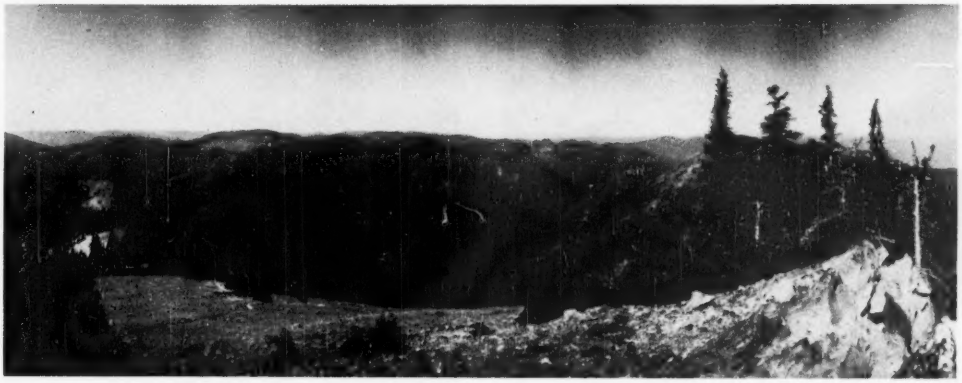
There is a rich literature on the birds of the sea. Putnam's *Birds of the Ocean*, by W. B. Alexander, is devoted exclusively to these birds, although it gives little on the life history and behavior of the birds discussed. *The Raft Book* by Howard Gatty, George Grady Press, so popular with those likely to be cast adrift in the sea in small boats, presents valuable observations on the behavior of sea birds in relation to the land at different seasons, and in different parts of the world.

In earlier inserts in this series, and in my *Fieldbook of Natural History*, I have presented illustrations and tabular material on more than thirty of these birds, the present eighteen not having been considered in this way before. This set brings the number of birds so treated to more than fifty, which includes representatives of most of the important major groups.

This list to date includes the following:

Penguins—Emperor, King, Royal, Gentoo and Jackass; Loon, Common; Albatross, Black-footed; Shearwater, Greater; Fulmar, Pacific; Petrels—Black, Storm, Wilson's; Tropic Bird, Red-billed; Pelicans—White, Brown; Booby; Gannet; Cormorant, Double-crested; Frigate Bird, or Man-of-War Bird; Eider, American; Scoter—American, White-winged, Surf; Osprey; Jaegers—Pomarine, Parasitic, Long-tailed; Skua; Gulls—Glaucous, Glaucous-winged, Great Black-backed, Herring, California, Ring-billed; Laughing, Franklin's, Bonaparte's, Kittiwake; Terns—Forster's, Common, Arctic, Sooty, Least, Royal, Caspian, Black, Noddy; Skimmer, Black; Murre, Atlantic; Auk, Razor-billed; Dovekie; Guillemot, Black; Puffin, Atlantic.

We do not here include material on the shore birds, or the birds of marshes that border the sea, any of which may be seen flying over the sea. Eventually, we will have such an insert, and for this we already have the illustrations completed and the plans perfected. When this finally appears, we will have, with the material already published, at least a hundred birds of the sea and associated wet lands. This should give reasonable coverage of these interesting birds for the amateurs for whom this material is prepared. So far as possible, we have avoided duplication in any of these inserts.



U.S. FOREST SERVICE PHOTOGRAPH

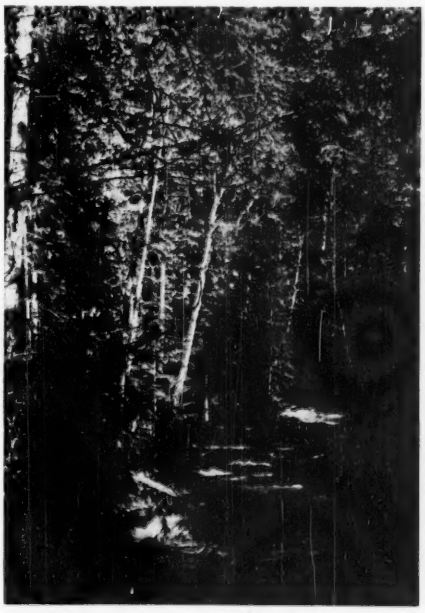
The view toward the southwest from the summit of Horsepasture Mountain is typical of the high, isolated peaks and ridges of the older western Cascades.

The Three Sisters Wilderness Area

By RUTH E. HOPSON

LUCKY is the wilderness explorer who travels within the 244,391 acres of the Three Sisters Wilderness Area of the central Cascade Mountains of Oregon. Here approximately 300 miles of forest trails follow clear white-water streams in deep canyons, through shady forests of virgin Douglas fir, up through the stands of lodgepole pine and true firs, across recent lava flows and mountain meadows and into groves of mountain hemlock. Now the hiker is free to leave the traveled path and find his own way above the last weather-beaten whitebark pines, across the living glaciers and on to the summit of one of the three 10,000-foot volcanic peaks for which the region is named. From one of these vantage points the visitor may view that singular line of volcanic cones that stretches north and south. On the clearest days one may see Mount Rainier in Washington, Mount Shasta in California, the Pacific Ocean in the west, and the Blue Mountains in the east.

Should the wilderness wanderer follow one of the trails that leads to the isolated ridges in the western part of the area, he may see the timbered slopes at close range, or waterfalls across the valley, or the volcanic cones to the north and south, and, best of all, the inspiring beauty of the Three Sisters Mountains close at hand.



PHOTOGRAPH BY THE AUTHOR

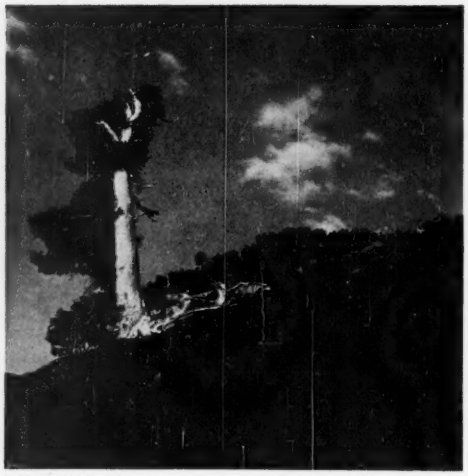
Horse Creek, near the lower boundary of the wilderness area, showing the dense forest and the clear, swift water.

A "wilderness area" within a National Forest is defined by the United States Forest Service as an area of at least 100,000 acres characterized by primitive conditions of transportation and habitation. No commercial timber cutting or permanent use of any kind is permitted. Although these areas are intended primarily for inspirational recreation, the Forest Service also recognizes their scientific and watershed values.

In the Three Sisters Wilderness Area, the retreating snowbanks of summer uncover a natural wonderland of prime recreational opportunities. Trails at lower elevations may be hiked during April or May, but are best in early June. The high country is usually free of snow and thus accessible from the last of July through September.

If the day is wet, as it often

Collier Glacier, late in July, 1950. This glacier the largest in Oregon, lies between the North and Middle Sisters.



Heavy snows and the wind direction are recorded by this white-bark pine near timberline along the Skyline Trail.

PHOTOGRAPHS BY THE AUTHOR

is during spring at lower elevations, it offers attractions of its own. On a rainy day, the verdant green of the associated plants in an old growth forest of Douglas fir imparts fresh beauty to the sylvan scene. Moisture drips from many spongy structures, all shiningly bright, almost "happy" green as they absorb this life-giving liquid. Lichens that were dull grayish-green, and limp or dried before the rain, are suddenly crisp and brilliant as they drink the moisture. Mosses are saturated, drops of water gleaming from each hanging tip. The resilient carpet that covers the forest floor is patterned in shades of green that are characteristic of the species of plants found there. With the coming of the rain, each is a more shining hue. The carpet oozes water with every step across it. Streams from such a forest are always clear, and are regulated in their flow.

Seasonal change from summer back to early spring is experienced in a continuous display in a one day's climb along a mountain trail. On June 3, 1951, twenty members of the Natural History Society of Eugene, Oregon, returned to early spring by way of a three-mile hike along the Horse Creek Trail. Elevation change was from 1900 feet to approximately 3000 feet in the range of this distance.

North, Middle and South Sisters from Deer Butte. Except for the trees in the immediate foreground, all is in the Wilderness Area.

The forest in this section is dominantly Douglas fir. Associated conifers are grand fir, western yew, western hemlock, incense cedar, western red cedar, and a few western white pines. Here the trees are largely second growth. Stumps, snags and half-decayed logs indicated that the former forest had grown larger. The Douglas fir forest is here because it quickly follows fire, which has always played an important part in the plant

PHOTOGRAPHS BY THE AUTHOR

Alto-cumulus clouds that formed briefly as the sun in rising provided a halo about the Middle Sister in the wilderness.

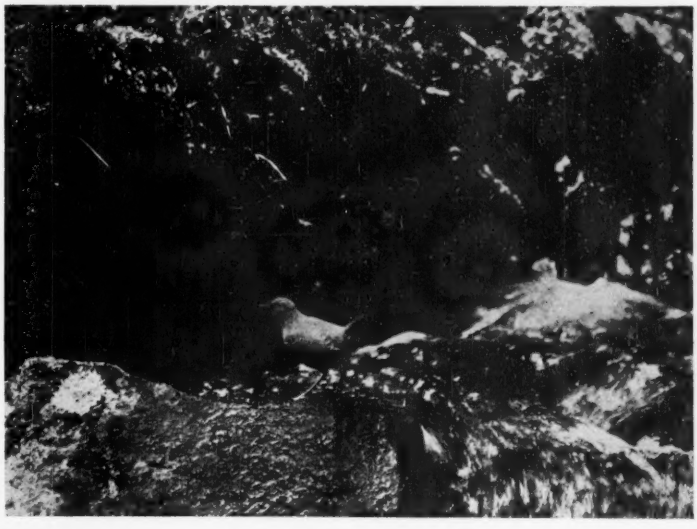
Part of the obsidian flow, rounded and scarred by Pleistocene glaciation. This is the scene from the Skyline Train near Middle Sister.

succession of this region. Although parts are second growth, still the forest represents the natural succession with no interference by man.

We passed western rhododendrons in bloom, then in bud; western flowering dogwood fading, then in showy sprays of flowering perfection; dwarf dogwood with its bracts still green and undeveloped; and, finally, one was back to the first spring flowers — woodland violets and western trilliums. A little higher on the trail we would have reached the winter season of budding twigs. All along the trail was luxuriant new growth of ferns of nine species. Black-throated gray warblers sang their upward spiraling song from the tops of tall Douglas firs; western fly-catchers called and dashed out from high perches in pursuit of insect prey.

We felt privileged to have witnessed even so small a part of the spring pageant in such primeval surroundings. We had only touched the edge of a wilderness area, but we planned to return and to go farther.

Scientifically, there is much that is not explored. Although most of the higher plants and animals are known, adequate collections of funguses, mosses, liverworts, and lichens have not been made, or of invertebrates, amphibians, and reptiles. The Horse Creek drainage is a watershed that is intact from the summit of the South Sister, at 10,300 feet elevation, down to the lower boundary of the wilderness area, at 1900 feet. Such a region is unique among wilderness areas of the Cascades of Oregon. As a scientific storehouse for the study of ecology, a type specimen of the western slope of the Cascades in its natural state, it is unsurpassed. A virgin stand that is left undisturbed has untold value



The wanderer in the Wilderness Area may come upon a water ouzel or dipper along any one of the mountain waterways.

as a wilderness laboratory for scientific investigation of Nature's processes of development.

On the trail to Horsepasture Mountain, one passes through old growth Douglas fir for several miles, from 1900 feet to approximately 3500 feet. Deep shade and intense silence are distinctive of such a forest, where the huge, widely spaced boles rise clear of branches for 300 feet or more, and where the light that reaches the forest floor is filtered through the dense canopy of touching crowns overhead. Low herbaceous plants, or a few shrubby ones less than a foot high, predominate, except where a break in the crown allows more light to enter. Saprophytes, such as, the ghostly Indian pipes, and many species of brilliantly colored mushrooms, grow in the forest duff. The interior of a forest such as this is practically destitute of bird life. Often one can hike for miles through such a forest without hearing a bird sound.

After a climb of 3200 feet over a six-mile forested trail that zigzags up the slopes and follows the ascending ridges, one reaches the saddle between Horsepasture and O'Leary mountains, at approximately 5000 feet in elevation. This is a part of a series of high, isolated peaks and sharp, serrated ridges that have been carved from volcanic deposits of the older Cascades, west of the more recent peaks that crown the main volcanic plateau of the higher and newer Cascades.

The composition of the forest here differs from that of the lower forest of Douglas fir, and from the forest at equivalent heights in the newer Cascades. The true firs are the major components of this forest, with mountain hemlocks second in number. Lodgepole pine, the species of conifer that is most abundant at equal elevations in the newer Cascades, is missing altogether. The type of forest found on the isolated peaks and ridges approaches a "climax forest" in which the species that pioneer a new land surface have already disappeared.

Deer are numerous around the ridges and peaks during July. A few years ago, a companion and I were camped at the shelter in the saddle between Horsepasture and O'Leary mountains. Just at dusk the noises began, as the larger animals gathered, still under the cover of the edge of the forest. All during the night the noises continued. In the morning, we found the ground beaten to dust. Deer tracks were numerous and one large cougar track was among them. The next day, when we were along the trail above the shelter, a blood-curdling scream sent us hurrying down the trail, until we remembered that we had no place to go. I have little doubt that the scream was that of a cougar.

Wolves are still found in this region, although they are reported as rare in the annual wildlife statistical report made in 1950 by the District Ranger at McKenzie Bridge.

Late July, August, September, and early October is high-country season. Along the Oregon Skyline Trail (part of the Pacific Crest Trail) come a variety of hikers and explorers. This section of the high Cascades is delightful for the vacationist who wishes to see Nature at her best and to feel the thrill of "being on his own" as he copes with the problems of simple living in such a region.

For here is much that is majestic — the array of cloud forms that sometimes precede the dawn over the Middle Sister; the rising sun forming a halo about its summit; the alpine glow intensifying the red of the volcanic formations of the North Sister; a mountain meadow that is a riot of blue and rose against a background of green as the lupine and paint-brush reach their climax; or the endless variety of shapes of the white-bark pines at timberline that record the story of the weather.

Distinctive are the sounds of geologic forces in action. Boulders clashing in rushing mountain torrents, streams gushing forth from springs in the sides of mountains, creeks tumbling over precipices, white waters of glacial streams playing their daily crescendos, and ringing clatter of rock avalanches dashing down the steep mountain sides, all produce sounds that are characteristic of the western base of the Three Sisters, sounds that reverberate from cliff to cliff and announce a region that is still vigorous in the stage of early youth.

Recent flows of jagged, blocky lava are found near the Sisters Mountains. Few forms of life have been able to find habitation in the rough, rugged wastes of inhospitable lava. Conies and marmots find the edges of the lava flows suitable for their homes. Scattered plants have gained a foothold.

Obsidian flows near the Middle Sister end in cliffs up to 300 feet in height. The surface of the flow was rounded and scarred by Pleistocene glaciers. Lakes form in the shallow depressions.

In August, 1928, the first summer camp of the then newly organized Eugene Outdoor Club was held at Obsidian Camp on the Skyline Trail, near the Middle Sister. The jet black obsidian suggested a new name for the club. Since the members were as hard as the rocks they walked upon, they became the Obsidians. The Three Sisters Wilderness Area is the scene of their

major activities — hikes, summer outings, mountain climbs.

Many species of alpine flowers greet the visitor along the Skyline Trail through this region in August. As though well planned, the mountain meadow is a natural flower garden, the vista constantly changing throughout its short growing season. The camper is often surprised at the apparent scarcity of bird life. The nesting season is passed and certain birds have already migrated, others are relatively quiet at this time. Flocking birds are the most numerous — pine siskins, Cassin's purple finch, and Sitka crossbills. Clark's nutcrackers and gray jays are noisy and conspicuous. The golden eagle is frequently seen about the summits of the mountains. The water ouzel or dipper may always be seen along any mountain waterway, or around the edges of the larger lakes, as well as along swift water at lower elevations.

Tracks of deer and elk are common. One day, I saw a herd of sixteen elk traveling single file along a ridge. A young bull with immense antlers was the leader. The herd was mostly cows and yearlings. A huge old bull that came at the end of the line was lame and had difficulty in keeping up.

Bears are not frequently seen, although the black bear is native and is found throughout the forests. Badgers are encountered occasionally in the high country near timberline. The talus at the foot of the high perpendicular cliffs is the home of the dusky cony. One often hears his high, thin call, but to see him one must sit still and search the huge pile of rocks until the cony appears again.

Timberline is irregular at approximately 7500 feet in elevation. Dark green lines of gnarled and twisted trees hug the windswept ridges. Trees become so dwarfed at timberline as to be hardly recognizable as trees.

Above timberline the over-all picture is that of barren volcanic rock, snow fields, and glaciers, stern and rugged. Fourteen glaciers occupy cirques in the sides of the Sisters. The largest is Collier Glacier, which is also the largest in Oregon.

From the lowest elevation of 1900 feet on Horse Creek, to the summit of the South Sister at 10,300 feet, four life zones are found within the Three Sisters Wilderness Area — the Humid Transition zone, where Douglas fir is dominant; the Canadian zone, where lodgepole pine and true firs are dominant; the Hudsonian zone, where mountain hemlock is dominant; and the Arctic-Alpine zone, where there are no trees.

The educational potentialities of this diverse wilderness have hardly been toched. Many locations are suitable for camping field schools for either children or adults who wish to live in the out-of-doors where the varied processes of Nature await observation and interpretation, where fun accompanies learning, and where motivation is supplied by everyday living in an environment charged with inspiring phenomena.

With all of its wonders, it is the continuity of the Three Sisters Wilderness Area that is supreme — altitudinal range with its succession of life zones undisturbed, extensive forests necessary to maintain the animal life in its natural state, geologic record from the late Miocene or early Pliocene, a flora and fauna adapted through changes of vulcanism, glaciation, and climate to this section of the Cascades and to the many individual habitats found there.

May this continuity be allowed to continue, appreciated but unspoiled by man! It is not yet too late in the Three Sisters Wilderness Area.

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Torn Tapestry

By JOHN GALLINARI WHIDDING

Arachne, legend-driven through the night,
Unreeled her thread and spun a gentle dream
Between the rosebush and the trellis-beam
Next door but one; a warp precisely right
To hold her weft, diaphanous and bright
With filaments of moon-glow and the gleam
Of golden stars — a tapestry extreme
In art's contriving — oh, a lovely sight!

But, with the sun, behold Minerva's wrath
As, full of housely cares, she plies a broom
And sighs to note along her dusty path
The matchless weaving spread upon the loom.
"Well, here's a pretty nuisance!"
All for naught. . .!
The miracles of God are dearly bought.

Sugaring for Moths

By EDITH RUTENIC McLEOD

"DON'T forget a pint of stale beer and three rotten bananas," I caution Ken, as he leaves after lunch, "and two pounds of brown sugar."

Lest one thinks we have strange dietary tastes, I assure you this is not for us; it is for the moths. We are going sugaring this evening; not for maple sugar but for the purpose of intoxicating moths.

In this sugaring operation we mix the stale beer, spoiled bananas and brown sugar and boil the result down to a syrup. This is smeared on tree trunks in the woods, and from it we then collect our choice of moths that come to our improvised bar to sip — and to get drunk. Making a collection of the moths, butterflies and other insects of Klamath County, in southern Oregon, is one of our hobbies.

It has been sultry all day. Heavy, white clouds hang over the horizon to the west, and there is a leaden bank of clouds to the northeast. Just the right kind of a night for good collecting is in prospect — a warm, cloudy, still night with a slight breeze, and with the sultry stillness that precedes a storm. In this high, mountain country we frequently have two or three such days, and then the deluge.

We set out about an hour before sundown. The little remnant of Aspen Lake lies in a long, open valley, shadowed from the fast-setting sun as it sinks behind the old crater, Aspen Butte, which looms abruptly over our collecting spot on the western edge of the valley. The whole little valley is rimmed by coniferous forests. Those behind us are still bright green and brown in the sunlight; those to the west are already growing misty and dark, blending with subtle harmony into the mountain above.

Big-trunked yellow pine trees, with their burnt-sienna, coarsely segmented bark, loom high overhead, with firs, cedars and clumps of aspen scattered among them. It is an ideal spot to collect insects, a combination of woods, open fields and stream, and an abundance of green growth in great variety. It is a good birding place, too, and an enchanting place for a party to hold picnics.

The author brushes the sweet mixture of cooked stale beer, brown sugar and overripe bananas on a tree, later to provide the moths with a heady drink.

First we must get out the brushes and smear our sticky mixture on the trees; on a dozen or more of them along the dim road running back toward the nearby mountain. We smear it on in a streak, the top about breast high. We will have to get it on early, as the underwings come out before dusk. From then on until midnight will be busy hours. After that there is a lull of an hour or two, followed by a milder rush that will last until dawn. Then the moths vanish to seek their daytime shelters. Our day is their night, and our night their day. But by midnight we will be ready to quit and leave the drunken, tippling moths to enjoy their one night of inebriety.

The western silk moth is a big, reddish fellow, the outer edges of its wings a cream color, a black eye at the tip of the fore wing and a pale crescent in the center of each hind wing.

Once the sticky syrup is smeared on we will wash our likewise sticky hands in the little stream and eat our supper, a much more sober one than the moths will enjoy this night. The twilight is warm and still, with the unforgettable scent of pines and firs. To our ears

comes the last twilight song of the birds, the muted sighing of a breeze in the tops of the pines, and its sibilant whisper in the aspens.

It is nearly dark now. Bats are circling overhead. A gustful little breeze dances by, trailing leaves in its wake and reminding us of the storm that is to come. The breeze dies away into the forest. We light the gas lantern and put the cyanide jars in our pockets. We have three of them, two to collect in, and one to hold the stupified insects for their final fifteen minutes.

Cautiously we approach a big pine, shining our lantern full on it. Light will not frighten the moths, but sudden movement or crackling twigs will, and they will dart off or drop in their efforts to escape. The syrup drops that have run down the furrows of the bark glisten in the lantern light. Ants are already investigating the drops and working their way up to the feast above. Do they never sleep? No moths here, only the ants, a black beetle and a lacewing. We do not want them.

We try the next tree, a fir. There is a moth — a pretty, tan, angle-winged fellow, a geometer, daintily sipping, its long, hollowed tongue curving out to touch the syrup. We may have it in our collection, but there are so many varieties of the geometers that we had better take it and find out later whether or not we already have it.

Looking up over the smear, we see a *Catocala*, a big, gray-marked underwing. Its fore wings match the bark in color and design; its under wings, only half showing, are a brilliant, orangy-red, with black bands across the borders. Usually the brilliant under wings are concealed as the moth rests on the bark of a tree, and it takes a sharp eye to see the insect. So perfect is its protective coloration that it resembles a loose flake of bark. We will take him. We slide the jar toward him carefully from below, for, at the least scare, the moth will drop down. It must be half drunk already, so we flick him lightly from above with a finger and he will drop into the jar.

There is nothing on the next tree but ants and a common, buff-colored moth. Over there is a pretty little moth with wings like white taffy streaked with silver — one of the grass moths — and a *Tarache*, white, with brown-tipped fore wings, and another anglewing, too. It appears to be different, so we take him. And there are some Noctuids (cutworms belong to this family), and since there are hundreds of species we take several that look different. We take the bottom ones first and work upward, unless we see a rare one.

By now we must empty our jars, for the moths must not brush against each other. As soon as the noctuid stops fluttering we lift it out by the legs or body, with forceps, never touching the wings, for the "dust" — the microscopic scales — will be brushed off, the specimen spoiled. We transfer the moths to the third jar, where they will be left for fifteen minutes. If taken out before that time they are apt to revive in the fresh air.

We visit tree after tree, selecting those moths that we want and making the circuit a number of times. As soon as the third jar is ready to be emptied we sit down on the mat of pine needles and gently dump the moths out on a newspaper. Ken folds little triangular envelopes of paper, while I carefully pick up each moth with the forceps, fold the wings up over the back and slip each one into a separate envelope, on which is marked the date, locality and by what means captured. We put the papered moths into a cigar box.

Above is a spread Catocala moth, and below, is one in normal resting position. The pattern of the fore wings blends with the pattern of the pine bark.

As we work we find a different *Catocala*, with white under wings banded in black. We slip up quietly, for this kind is not common here and we want it. There are a lot of noctuids and geometers out tonight. How their eyes gleam in the lantern light, as though tiny coals burned inside! As long as life remains their eyes shine, although dimly toward the last. With death the last gleam disappears.

The sighing of a breeze flutters around us. Or, perhaps, it is not the breeze this time. Possibly it is the moths bewailing, with Omar Khayyam:

"Oh Thou, who didst with pitfall and with gin
Beset the road I was to wander in."

Only certain moths are attracted by sugaring. Others respond to light, but many moths cannot be collected by either of these devices, and other methods must be resorted to. So we leave our sugaring and wander down to the stream to collect by light. How the insects flutter and swarm around the lantern! Most of them

are common ones, but we are sure we want some.

We will have to use our nets now, although some moths settle on our clothes and can be easily flicked into the jar. For half an hour we work, and then, all of a sudden, not a moth is in sight. Is our night's collecting over, we wonder? But presently there comes one, a second, a third, another and another, a dozen swirling madly around the lantern, making visible circles against the blackness of the night. How can they move so fast and never collide with one another? It is difficult to pick out the ones we want and get them into the net.

By now I am tired, so we sit down on the little bridge and eat a candy bar. It is so hushed and lovely here. Our light embroiders a circle of green filigree on the canopy of the night-darkened forest. The black brook chuckles below our dangling feet. A little green tree-frog squats on a big leaf, perhaps wondering why the sun came up so soon. Here it is daytime again and he has not gotten his little stomach half filled yet.

Now we go back to make another circuit of the sugared trees, for it will soon be getting chilly. What was that big thing that swept by? It was too big for one of our moths, yet not big enough for a bird or bat, and too low down too. There it goes again. Why, it is a big moth of some kind! We try to net it; miss. It is over there by the trees. There it goes! Quick! We are careful not to let it flutter in the net or it will damage its wings. What a beauty! A big, reddish fellow, banded at the outer edges of the wings with cream, a black eye at the tip of the fore wing and a pale crescent in the center of each wing. It seems a pity to kill it, but we will only take one. It is a *Samia rubra*, the western silkmoth — not the kind that produces the silk of commerce, but of the same family. They are rather uncommon here.

We recall an unhappy experience here one night. Pushing through headhigh ceanothus bushes with our lantern, in search of the large, green caterpillars of *Samia rubra*, we startled a mother bird off her nest. Four baby birds raised their heads and popped open their pink mouths as we softly withdrew. We chose another section of the woods for that night, that the mother bird might return without fear to her nest. But she never came back. Three weeks later we were up there again and hunted up the nest to see if the babies had flown away. They were all dead in the nest. Some accident must have befallen the mother bird, for we do not believe that she would have deserted her babies, but, nevertheless, we were inadvertently the unfortunate cause of the tragedy, and we felt sad.

And so the collecting goes until midnight. Body-weary and with the chill that is creeping up, we decide it is time to go home and to bed. There will be some busy evenings ahead, for the moths will have to be relaxed, the wings spread, dried, and then pinned in display boxes. It seems like a lot of work, but if you are a moth enthusiast it is fun; is certainly not work.

A Mullein "Mystery"

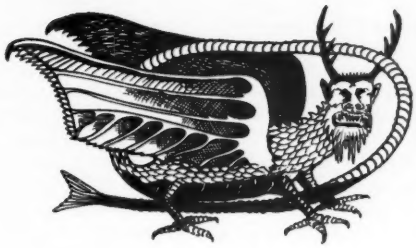
By GLENN R. DOWNING

THE common mullein, *Verbascum thapsus*, is a common summer weed with a rank growth, producing yellow flowers upon its tall, spike-like stalk. It is found growing in dry fields and on hillsides. At the bottom of a hillside I found a row of these plants, shown in the accompanying photograph, growing in such a perfectly straight row as to give the appearance of someone having planted them there. The plants had followed an old fire-lane furrow, which had been plowed to keep swamp fires from spreading up the slope. The row of mulleins were fifty feet from the swamp. Other mullein plants were scattered over the hillside but none went beyond the row established by the furrow. Why had these weeds, which nearly everyone ignores, planted themselves in such a perfectly straight line along the old furrow? Why had they stopped at exactly this distance from the swamp and proceeded no farther?

[Editor's Note: While we have not deleted the word "mystery" from the author's title, we must point out that a furrow often provides a congenial site for plants. Whether the seeds have been sown by wind or flowing water, a furrow, even if already partially occupied, may detain and nourish later visitors.]

Piasa Country

By VIRGINIA S. EIFERT



The Piasa Bird of the Illiniwek Indians as reconstructed by William McAdams, Illinois State Geologist, from the descriptions of those who had seen the pictographs on the white cliffs above the Mississippi River. These pictographs were described by Father Marquette in his journal.

THERE came a thundering and a flashing like lightning, yet the day was calm and bright, the summer morning clear and gay along the great river. There came a rush of dark wings from the cave high up on the white cliffs, and all living creatures in the forest, or over the river, or on the shores froze in terror. For the Piasa Bird had come forth on its hunting flight, and no animal or Indian along the white palisade of cliffs above the Mississippi was safe from its claws.

The Piasa, said the Illiniwek, ranged along the white cliffs, which rise up on the Illinois shore of the Mississippi from the great curve at the present town of Grafton to the city of Alton, near St. Louis. This was, and still is called, the Piasa Country. The Illiniwek had discovered the Piasa's lair in a cave high on one of the white cliffs, had found it covered with human bones, and hastened away in wordless horror.

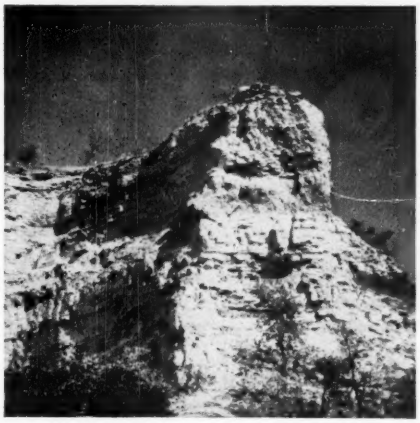
Daily the Piasa came forth and sought an Indian for his dinner.

At last the old chief, Ouatoga, received a vision in which he learned that he must sacrifice himself to rid the tribe of the monster. He instructed six of his bravest young men to prepare poisoned arrows. He stationed them in the sumac bushes on a cliff top, and when morning came Ouatoga walked out on the windy cliff and waited.

Below him the ancient Mississippi lay broadly, sparkling in the morning sunshine, and beyond lay the green meadows and broad marshes stretching between the Great River to the Missouri. Down the tribal shore the great sculptured white cliffs extended as far as he could see. It was a beautiful, sweet morning and life seemed very good. A wind from the river swept the cliffs with a bath of invigorating air.

And then he heard a thundering in the air and saw flashes that were like lightning, and looked up to see the Piasa Bird coming.

Ouatoga threw himself down on the white rock and held tightly to a little scrubby oak bush rooted deeply in the rock. And just as the monster pounced, the braves shot their poisoned arrows, and the Piasa Bird was mortally wounded. It rolled, flapping and screaming, over the cliff and down, down, to splash in the river. And no one ever saw the Piasa Bird again.



The white cliffs are buttressed, and strangely carved by time, weather, water and the winds that sweep along the river.

But the Illiniwek, grateful for their deliverance, incised and painted two pictures of the Bird on the face of a smooth white cliff above the river. And whenever a canoe full of Indians passed below the rocks, they shot arrows at the pictographs until their surfaces were pitted with marks of arrowheads. Later Indians, passing below, shot bullets, the marks of which added to the destruction of the fading figures on the rocks.

No one knows when the pictographs of the mythical Piasa Bird were placed on the rocks near where Alton, Illinois, now stands. But they were there in 1673; there are records of that. For when Father Marquette came with his men in canoes along the Great River, and rounded a curve of white cliffs, they looked up and saw two monsters. This, in part, is what he said in his journal that day. . . . "we beheld two monsters painted on the lofty limestone promontory. Each of these frightful figures had the face of a man, the horns of a deer, the beard of a tiger, the wings of a bat, and the tail of a fish, so long that it passed around the body, over the head, and between the legs."

But today the paintings are as completely vanished as the mysterious Piasa Bird itself. It is a great loss to the Illinois Country and to America that the Piasa paintings were destroyed before any photographic record was made of them. For, in 1856, a new quarry at Alton casually and completely blasted them away. But there were men who had seen the pictographs, men who remembered. Some of them described them so well to Professor William McAdams, Illi-

nois State Geologist, that he made a drawing of the Piasa Bird, let his advisers, who had seen the originals, check it, made necessary changes, and thus gave the Piasa Bird to posterity. It is this reconstructed drawing, by a man who never saw the original, that is the only record of what was painted, long ago, on the white palisades of the Piasa Country.

The Piasa Bird remains as a spectral presence along the sunny, mysterious white cliffs, which stand tall and sculptured above the Mississippi. These cliffs are of white limestone and contain the last of the trilobites. Quarries have been made along the cliffs, but their massiveness has been little changed by the puny peckings of man.

In a cave, high on a cliff near the village of Grafton and Pere Marquette State Park, and at the juncture of the Illinois and Mississippi Rivers, the Piasa Bird was said to have had its lair. Archaeologists many years ago climbed into it with great difficulty, and, as the Illiniwek had said, found it littered with human bones. The archaeologists concluded that the cave was, rather, a prehistoric Indian burial place, but since that time little or nothing has been done to determine the stories of the cave and its contents. It has been ignored, all but forgotten. It is as if the spirit of the Piasa still hovers over its den and discourages men from staying long.

The white cliffs where once dwelt the Piasa Bird. This is on the Illinois shore of the Mississippi, looking up the river.

The cliffs of the Piasa Country do not form a straight wall of rock. They are buttressed, strangely carved by time, weather, water, and by the tremendous winds that sweep along the Mississippi. The cliffs push out in a great curve, recede in stony undulations to form shallow white canyons, or stand as great tables of rock on limestone pillars. Ancient red cedars cling to some of the cliff faces. In springtime the wild columbine dangles its scarlet and gold trumpets for the hummingbirds. There is the incongruous combination of deciduous holly and the big soft leaves and purple blossoms of paulownia, the latter escaped from cultivation up on the cliffs. For on the Piasa cliffs above the little river village of Elsah is the campus of The Principia, Christian Science college, in one of the most unusual, idyllic situations to be found at any seat of learning in America. The college looks out over the broad and shining Mississsippi far below the white cliffs, out beyond to the green marshes of the land of St. Charles County, Missouri, between the Mississsippi and the Missouri — Marais Temps Clair and Marais Croche and the Dardenne marshes, the great bird marshes along the Mississippi flyway. The college chapel dominates the cliffs. Its pleasant chimes, sounding the quarters of the hour, may be heard far across the river and all along the white cliffs where the Piasa was said to have ranged for food and his evening Indian.

Below, in a hollow between high hills which open out as white cliffs along the river, is Elsah, the little river village that is all but forgotten. It is away from any traveled highway; in its quiet charm it is unique among Illinois villages. It has two streets on different levels, which come down to meet at the water front; interesting old houses, some made of limestone quarried from the cliffs and sheathed in English ivy, some built of New England brick; the Village Inn, once a river captain's house with a captain's watch on top, overlooking the river. And past the water front today move the tow boats and their long strings of barges going up to St. Paul or Chicago, or downriver to St. Louis or New Orleans. The towboats give a long blast of their whistles as they pass, or flash their lights at night; the boats always signal Elsah and Mrs. Rhodes, who signals back at them.

There is a backwater pond where frogs are loud on a spring night. In the quiet water stand tall dead trees where tree swallows, house wrens and prothonotary warblers nest in old woodpecker holes, while the red-headed woodpeckers yammer and fly about all day long. Sometimes a pileated woodpecker, like a creature out of the far past, comes to the dead trees to chisel off great slabs of wood in search of grubs. In summer there are always egrets and great blue herons out on the mud bars of islands in the river. It is then in summer that the backwater pond becomes low and green with algae. Arrowhead lilies bloom in a great colony; duckweed and tiny water ferns, *Azolla*, cover water not occupied by algae or milfoil. And large, green-faced bullfrogs lie supine among the algae and *Azolla*, with

just their golden eyes and noses out of the water.

And upon the great white cliffs the passing seasons leave their transient mark. The timelessness of Time moves over the limestone, brings spring and summer and autumn and winter, yet leaves the rock virtually unchanged. In the snows and bare trees of winter the winterberry bushes still shine with their scarlet fruits. Spring, and the shooting stars and columbines, the bloodroot and large nodding trilliums, are in bloom in the rich black earth of ravines. There are new velvety oak leaves and panicles of flowers on the wild raisin trees, the glory of pink redbud and the fragrance of wild plum, then the splendor of white dogwood on all the hills when spring migration drops thousands of birds to rest and feed in the cliff country. On the campus the apple orchard blooms and the lilacs up there are heavy with scent; the paulownia blooms purple. And in village and ravine are masses of wild blue phlox and bluebells, gay in the April sun.

Then summer, and the cliffs are green and hot. The white faces of the cliffs are dazzling in sunlight and river sparkle; hornets and phoebes and swallows nest upon them. Autumn, and the panorama of oaks and scarlet dogwood paints the cliffs, the color accented by their whiteness and the blue of sky and river. Hawks pass over each day in October; eagles follow the air currents above the cliffs. Prairie grasses on the cliff tops bend in the bright wind.

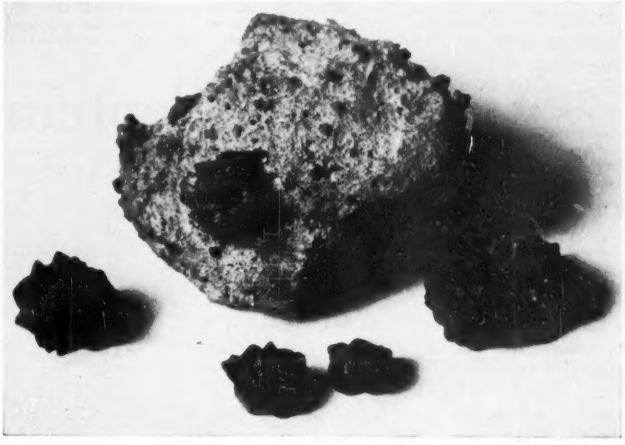
Then winter, and the river on a crackling-cold night freezes over so that not even the ice-breaker boats can get through, and only the herring gulls, ranging tirelessly along open water, give life to the cliff country of the Piasa.

No one knows what the Piasa Bird really was. Perhaps it represented the mythical Thunder Bird, which most Indian tribes held in awe; the fire-breathing, thunder-voiced creature with the figure of a great bird, serpent, or mammal, or a combination, as in this case, of all three. No one knows. Always the mystery of the Piasa will lurk in these white cliffs, its old home.

★

"Black Diamonds" from the Pribilofs

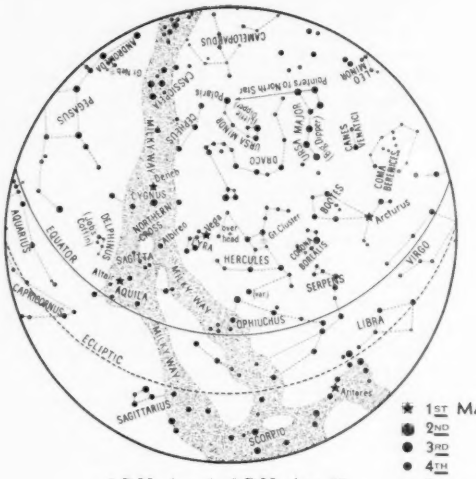
By VICTOR B. SCHEFFER



THE Pribilofs are the low, rocky islands in Alaska where the fur seals land each summer to bear their young. The islands are volcanic in origin, the result of lava flows and violent action, some of it underneath and some of it above the floor of the shallow Bering Sea. The present-day signs of volcanic activity are numerous explosion craters, fields strewn with volcanic bombs, and sheets of congealed lava.

Near the village of St. Paul is a small hill in which the native children like to dig for "black diamonds." The hill is composed of a mixture of wind-blown beach sand and scoria, or rock froth. The scoria is reddish to black, and in appearance quite like an ordinary cinder. As it disintegrates in the Arctic wind and frost it reveals an occasional cluster of shiny black crystals. The clusters range in size from some barely visible to others a half-inch in diameter. They tend to slide down the hills coming to rest eventually at its base.

Prof. G. E. Goodspeed, of the University of Washington, has looked at samples of the "black diamonds" and reports that he has never seen rocks like them before. He obligingly states that "they are a peculiar form of basic volcanic rock. They consist predominantly of crystals of augite, calcium-magnesium-iron silicate belonging to the pyroxene family. A thin section shows a few small, lath-shaped crystals of plagioclase feldspar interstitially with the augite. This material was probably formed by a volcanic eruption of partially crystallized lava. Some of the augite crystals show distinct monoclinic forms, especially short thick prisms with simple twinning, others are partially rounded. Aside from their interest to the geologist the "black diamonds" have no real value.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TAURUS
ARIES
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Polaris
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Altair
Antares
Vega
Deneb
Cor Caroli
Alkaid
Mizar
Pointers to North Star
Pointers to Polaris
Great Square
Northern Cross
Keystone
Dipper
Coathanger
Kite
Sickle
Lion
Little Dipper
Big Dipper
Head of Hydra
Tail of Hydra
Heart of Hydra
Head of Serpent
Tail of Serpent
Body of Serpent
Body of Hydra
Tail of Hydra

than five miles outside the northern limit.

At time of greatest eclipse, if one is inside the path, the black body of the moon will be seen projected against the sun. At the beginning of the annular phase the western edge of the moon will have a single point of contact with the western edge of the sun, and, immediately afterward, a thin line of light will separate the two and an annulus of light will surround the moon. During the annular phase of the eclipse all but about four percent of the light of the sun will be cut off by the moon. At the end of the annular phase, about two minutes, forty seconds later, if one is at the center of the path, the eastern edges of the sun and moon will come into contact and the annulus will break at this point. The exact position of these points of contact will vary with the location of the observer inside the path.

One should be extremely careful not to look at the sun directly, but to use a piece of dense, exposed film. Ordinary dark glasses will not be sufficient protection for the eyes. Serious injury to the eyes may result if one does not take these precautions. If one wishes to observe this eclipse it will be necessary to be up at sunrise, as the sun will rise eclipsed shortly before the annular phase. At Newport News, one of the most favorable positions, the annular phase will begin at about two and one half minutes before 7 A.M., and will end a few seconds after 7 A.M., Eastern Daylight Time. The partial phase of the eclipse following will end about 8:07 A.M. there.

Partial phases of this eclipse will be visible in the eastern and east-central part of the United States, the sun rising in most places partly eclipsed, the magnitude of greatest eclipse being larger the closer one is to the annular path. There will be a large partial eclipse at Washington, D. C. There the sun will rise partly eclipsed, and the greatest eclipse of 92 hundredths of the sun's diameter will occur at 7:00 A.M., and the eclipse will end at 8:07 A.M., Eastern Daylight Time. At New York City the greatest magnitude will be 87 hundredths of the sun's diameter at 7:01 A.M. At Chicago, and in most of the central states, the greatest eclipse will occur before sunrise. In all of New York State and in New England there will be large partial eclipses of more than 80 hundredths, occuring about 7 A.M., Eastern Daylight Time.

After the path of the annular phase of this eclipse leaves the Virginia Capes it crosses the Atlantic Ocean in a southeasterly direction to the African Coast, in latitude about 24 degrees north, and, after crossing the continent in a southeasterly direction, leaves the earth at sunset in Madagascar. Partial eclipses will be visible in all of Africa, the Atlantic Ocean, British Isles, and southwestern Europe, as well as eastern and central Canada, southern Greenland, and Iceland.

There was, on May 28, 1900, a total eclipse of the sun in which the path of totality crossed the southern states from New Orleans through Mobile, across Georgia to Raleigh, and Norfolk. Many fine observations were made of this eclipse by a number of scientific expeditions. Not until May 30, 1984, will the central line of another eclipse pass through Virginia. This will be a total-annular eclipse, total in the middle of its path and annular near the beginning and ending. It will probably be total in the United States.

Although annular eclipses are not as valuable scientifically as total eclipses, and the corona is not visible because the sunlight is not completely blotted out by the moon, there are still many scientific observations that can be made at such a time, especially in studies of the ionosphere. The effect of refraction upon the times of occurrence of the phases of the eclipse at very low altitudes should be quite noticeable within the path of annular eclipse in this case especially in the western part. In observing an eclipse that occurs so near the horizon special care must be taken, particularly at high elevations, to see that a clear view of the horizon can be obtained in the vicinity of the rising sun. Clouds close to the horizon may be particularly troublesome in such an eclipse, as well as atmospheric dust.

An interesting recent occurrence has been the appearance of an unusually large group of sunspots observed at the Naval Observatory in Washington on May 18. It was followed, as often happens, by serious disturbances in the ionosphere, affecting radio and telegraphic communications. The strange feature about this large sunspot group was the fact that it appeared at a time when the sunspot maximum is long past and period of sunspot minimum is approaching. The last sunspot maximum reached a first peak in the spring of 1947, and a secondary peak in the spring of 1948. The sunspot minimum period, when the sun should be free of spots for days at a time, should come in 1952 or 1953.

The usual display of meteors belonging to the periodic swarm of the Perseids should appear on August 11-12. These meteors occur in greatest numbers well after midnight. The Perseids are so well distributed along their path that members of the swarm may appear over a period of three weeks or more, from the latter part of July until after the middle of August.

The planet Mercury will be at its greatest eastern elongation in the evening sky on August 3, but this is an unfavorable elongation (Continued on page 386)

August Moon

By GERHARD FRIEDRICH

Across the hill and by the murmuring brook
The crickets chirp their midnight serenade.
Earth, like a poem in a precious book,
Seems strangely woven out of light and shade.

All things have lost their weight, and rest and dream,
And while they dream, they smile mysteriously.
And higher climbs the moon above the stream,
A silent symbol of eternity.

The School Page

By E. LAURENCE PALMER

Professor of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

SEA BIRDS AND SCHOOLS

IT MAY sound ridiculous to suggest that sea birds be studied in schools the length of the land, and that they be observed directly and not merely studied from books. However, few places in the country are not visited by gulls, which congregate at the garbage dumps, or glean insects from the lawns, or perch on the monuments in the public square. We see many sea gulls far from the sea, no matter where we live. The reasons for this, of course, are associated primarily with the mastery of flight that has been attained by these animals. Home to them is wherever there is suitable food, and it may be a long distance between meals for a gull. But what is distance to a bird so perfectly streamlined that it can fly into a wind?

In the study of mathematics, physics, biology, health, art, literature and geography, sea birds have significance that is worthy of investigation. Children who have watched trout remain in position, apparently without effort, in a rapidly flowing stream may not be surprised at the ability of a gull to remain suspended in flight in another rapidly moving element — the air. Youngsters interested in model airplanes, and to whom the cross-section of the wing of a jet plane is intriguing, may well look with care at the cross-section of a wing of a gull.

The mechanics whereby a downward-pressing bird's wing lets little air through, while an upward-raised wing acts as a sieve, are worth investigating. This can be done by attempting to thrust the extended fingers downward or upward through the extended wing of such a bird. The wings of airplanes that are designed to serve as fighters, as bombers and as transports find their counterparts in the wings of terns, gulls and pelicans. And, if the wings are significant, then the tails are equally so. Just look at the tails of the eighteen birds shown in the special insert in this issue and you will recognize great differences. Watch the downward thrust of the tail of any of these birds when it prepares to light, and puts on the brakes before coming to rest. Tails aid the maneuverability of birds, just as they do to planes.

The feet of sea birds are worth careful observation. While most of these birds have webbed feet, and consequently may be expected to swim well, the webbing is by no means uniform, and the degree to which the feet are used for swimming varies even more greatly. Some of the birds float high on the water, while others not only float rather deeply submerged, but some have the ability to vary the degree to which they let themselves sink in the water. The positions of the legs, far to the rear of the body, or placed farther forward, have reasons. Divers, swimmers and walkers obviously must meet different challenges, and the position of the legs help meet these situations. The teacher who cannot find physics lessons in this field must lack imagination, or be a confirmed conservative so far as teaching is concerned.

The relative differences between the size of the bird and its wing-spread must not be overlooked. Compare the wing-spread of a scoter and of a man-of-war bird to get some idea of how important this relationship may be. The heavy-bodied, short-winged scoters and penguins are a far cry from the man-of-war bird, with its body the size of a small hawk and its wing-spread of eight feet. No wonder the man-of-war bird has structures that increase its effectiveness in flight.

The biologist will find that these birds may have staunch defenders, or equally excited critics. If a gull eats grasshoppers, it is considered good; if it eats the eggs and young of ducks, it is denounced. Who is to say which is right? But, before we reach a decision with respect to these birds, we must have access to all the facts that we can get. With omnivorous feeders such as sea birds, an individual bird judged by its acts, may be entitled to the highest praise as it takes one mouthful and strong criticism with the next mouthful.

Some of these birds may feed on the carcasses of animals that died because of some infections, and thus might be instrumental in disseminating disease organisms. At the same time, in feeding, they quickly remove otherwise undesirable wastes.

The versatility of some sea birds, so far as their appetites are concerned, makes them highly useful at times. Anyone who has watched gulls following a plow or a cultivator in the field can get some idea of the role these birds may play in controlling the numbers of pest species.

Why these often large birds continue to exist, while other species become reduced in number when associated with man, calls for explanation. Obviously, the fact that the flesh of most of these birds is inedible has something to do with the case. But why more of them are not shot as living targets is hard to explain, unless they win sanctuary by their sheer beauty when on the wing, as well as through protection by the law.

The art teacher will possibly find it interesting to examine the conventional sea bird on the average seascape to discover if it is possible to make a reasonable identification. We have in our home a painting made of a sailing ship operated in Civil War times by one of the family's ancestors. There are sea birds galore in the picture, but some in the immediate foreground must have been the size of bumblebees, or mosquitoes, if we apply the laws of perspective to them, and compare them with the size of men shown in the background. Few of those who admire the picture seem to worry about this conspicuous inaccuracy.

The literature teacher will find sea birds referred to again and again in stories with a marine setting. Few such stories are sufficiently definitive in referring to the birds to make the most of the opportunities the birds provide. This is unfortunate. The insert in this issue gives some examples.

The geography teacher will find plenty of suggestive material on sea birds. The tabular material here presented will show the wide areas covered by some of these birds. Since many of them move from one hemisphere to another, it may be worth while to consider how the seasons differ in the two Americas, and what this means to the birds.

Economic geography teachers will be interested in the story of the production of guano on parts of the west coast of South America, where climatic conditions are such that the birds' wastes are not washed away and lost with the rains. What these fertilizers mean economically to this part of the world is worth recognizing. Since many of these birds have a high fish diet, this, of course, affects the chemical nature of the wastes discharged by the birds. There are fundamental reasons why this is important, of course.

There are plenty of brain teasers that come to the attention of any who study these birds. How, for example, can a bird lay an egg high on an exposed rock, disturb the egg when the bird takes to flight and not have the egg roll off the rock? This may lend itself to a little practical experimentation to see if an egg would roll off a rock, or if it would normally roll in a circle. Such an experiment should help one to understand why there are advantages in having eggs that are not spherical. Of course, where birds, like the ducks, lay many eggs, there is an equal advantage in that where such eggs are left in the nest, with the smaller end towards the center, a larger number of eggs may be covered by the warm body of the incubating parent than would be the case where the eggs spheres.

With some of our sea birds, the incubation period and the period of youthful helplessness and dependence are surprisingly long. Under such circumstances, it is only natural that birds with a long period of vulnerability to attack by enemies must start life on lands where there are few such enemies, or just not survive, that is all. On the other hand, birds that do nest in such safe places must be expected to lay relatively few eggs, unless their numbers are to become legion and their abundance a threat to other living things.

I rather think that their esthetic value ranks over and above all these academic, practical and interesting angles connected with the study of these birds. I am sure I have emphasized my evaluation of this in the main discussion in the insert.

Caravan Camps

Starting from a deep appreciation of the pleasure to be derived from knowing the outdoors with which one is associating, Caravan Camps seeks to give adults and 'teen-age groups something different in the way of outdoor experiences in the Pacific Northwest. Its leaders are trained in outdoor living. These are peripatetic camps that take advantage of the wealth of outdoor opportunity of the region. Full information is available from Hazel Chapman, 4726 Roberts Way, Seattle 99, Washington.

Conservation in Greece

Word comes from Athens, Greece, and from Jacques Santorinéos, of the establishment of the Hellenic Society for the Protection of Nature. The formation of the Society was inspired by the International Union for the Protection of Nature, to the Second General Assembly of which, held in Brussels in October, 1950, Mr. Santorinéos was a delegate. Objectives of the Society are to organize, coordinate and direct preservation of wildlife and natural environment in Greece, to further establishment of national parks and similar reservations, and to carry on a program of public education. Immediate goals are reestablishment of two abandoned national parks, one on famous Mount Olympus and the other on Mount Parnassus. Another project is a national park in the Pindus Mountain range. Creation of a reserve to save a rare species of wild goat on the island of Antimilos is also sought. Preparation of conservation materials for teachers and pupils is regarded as a first essential, and a conservation magazine is contemplated. Headquarters of the Society is at the Geological Laboratory and Museum of the University of Athens.

Girl Scout Projects

"Everything in Nature has its work to do," Mrs. Herbert C. Hoover once said. "We may not always know what that work *is*, but as conservationists we make every effort to find out. To needlessly kill any form of life, to be unmindful and careless about the condition of any of the natural resources of this country, is not living up to the spirit of a Girl Scout's promise of duty to her country."

Until her death in 1944, Mrs. Hoover was active in her leadership in the Girl Scouts of America, a trained naturalist and a sincere conservationist. It is, therefore, most appropriate that the Girl Scouts should dedicate to Lou Henry Hoover a group of Memorial Conservation Projects. Two recent bulletins of the organization outline and implement with advice such programs. One gives instruction on "How to Make Your Camp Site A Wildlife Sanctuary," and the other deals with "Nature in Camp." A third publication bears the title "Ranger Aides" and is a project in conservation for senior Scouts.

NATURE GAMES

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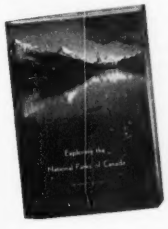
EXPLORING THE NATIONAL PARKS OF CANADA



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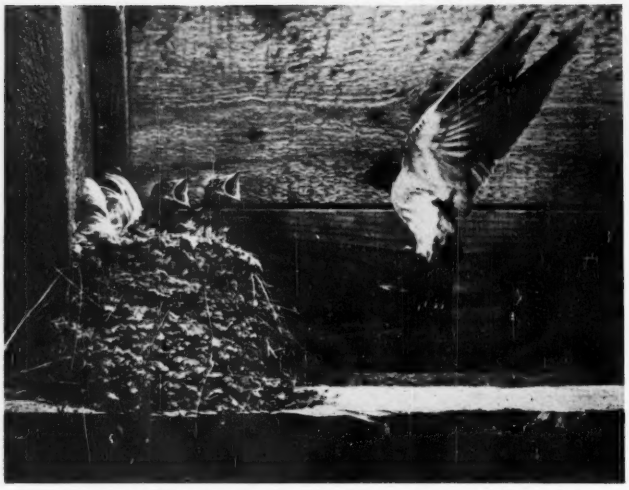
American Nature Association, 1214 16th St., N. W. Washington 6, D. C.

Camera Trails

By
EDNA HOFFMAN EVANS



"Barn Swallow" by Eliot Porter won honorable mention in the Chicago Nature photography show.

HAVE you ever noticed how doing something you like to do, even when you are so dog tired and grumpy that you feel like biting yourself and snarling at everyone else, can change your whole attitude and disposition? It works that way for me, anyway.

The other day I got home, tired, hot, and disgruntled. At first I thought I would take a nap, and then I decided not to. Instead, I decided to take a picture of my dog. I had not done so for several months, and she had grown from the final stage of puppyhood since I had actually tried to take her portrait. Besides, she had recently had a bath — but all that does not matter. What I am trying to point out is the therapeutic value of photography.

I got out the paraphernalia, camera and tripod, and I set up the "stage" and background. I fiddled with lighting and experimented with possible timing and exposures. All in all, I worked a lot harder than I would have ordinarily.

The pup seemed to catch the spirit, too. She was most cooperative, and I had the feeling that she was trying hard to do just what I wanted her to do.

At the end of a half-hour or so I was feeling much better. The world was not such a bad place after all, and people were not such pains-in-the-neck, either. Despite the energy I had expended, I was not nearly as tired as I had been. In fact, I was refreshed, interested, and enthusiastic.

That little session of photography did more for me, mentally and physically, than a nap possibly could. Try it yourself sometime and see whether it does not work that way for you, too.

Of course, I do not claim that photography is the one and only way to shed the blues. Any hobby will do, provided you are interested enough to get a "bang" out of doing it. I certainly feel sorry for people who do not have some vital interest or hobby to help them lose their cares and forget the tasks and annoyances of a dull and tiring day.

It is not hard to look around and pick out the people who have some important (to them) interest, and those who have none. There is a sparkle in the eye and a spring in the step of the interested individual, while the uninterested person seems to drag on from one day to the next with little in the way of zip to keep him going.

The hobbyist is bound to be kidded — and even ridiculed — sometimes. Kidding, even from friends, is sometimes hard to take, but often it, and the ridicule, as well, stem from some deep-seated feeling of envy in the heart of the other person.

A fellow learns by experience how to cope with the reactions of other people. Not one of my close friends is a camera enthusiast; in fact, not one of them knows what I am talking about when I mention shutter speed, or mumble to myself about exposure or lighting. But they are tolerant of me; some of them even go along on my picture-taking expeditions and wait with remarkable patience while I maneuver and sight, change position, test the light, and talk to myself, as all camera enthusiasts do.

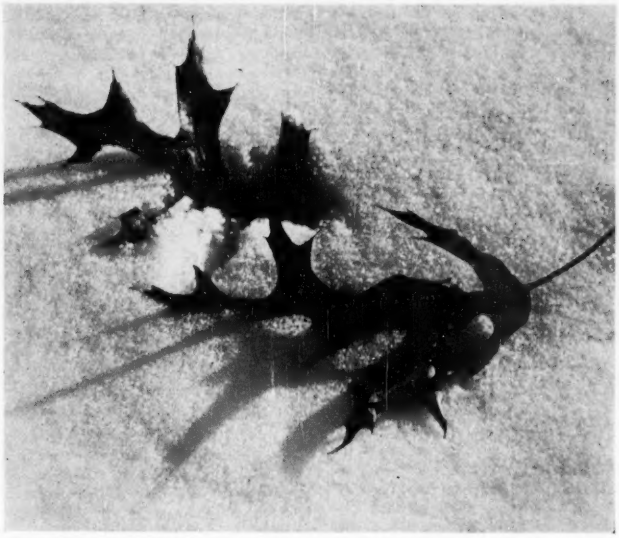
If I am careful, and sort of sneak up on them as I would a nesting bird or some other especially shy subject, I can even show off some of my slides now and then. And I really think, once the show is started, my victims even manage to get enjoyment out of it.

In a way it is too bad that photography is a rather individual hobby. Most photographers are lone operators, or, if they have a wife, husband, or friend who goes along, that other person usually goes in the role of chief carrier and errand runner, rather than as a second and equally important photographer.

Sometimes camera clubs operate as a group, taking field trips and clicking their shutters more or less in unison at some mutually acceptable subject. But a club is more of an after-the-picture-is-taken proposition. In clubs the members tend to pay more attention to the techniques of printing and composition. The original picture is taken by an individual, and is processed in the darkroom in solitude.

"Family Group" by Dr. Grant Haist received honorable mention in the Chicago show.

"Dangerous Curves" by Mike Bishop, an honorable mention winner in the Chicago show.



"Cold Storage" by Roy Schubert, from the 1951 Chicago Nature photography exhibition. It shows what can be done with simple properties.

A group of photographers who share a fine hobby, I think, are the members of the Nature Camera Club of Chicago. I have mentioned them in this department several times, and, while my acquaintance with them is strictly via mail, I think they must be an interesting and enthusiastic lot. Guided by their slogan — "To make the photographer a better naturalist; to make the naturalist a better photographer"— they are even now working on plans to make their seventh annual international exhibition of Nature photography a more outstanding event than its predecessors were.

Each succeeding year the exhibit has grown. For the display that was held at the Chicago Natural History Museum in February, 1951, a total of some 2280 slides and 530 prints were received from Nature photography enthusiasts in many parts of the world. In addition to those from the United States, entries came from such widely separated sections of the globe as Hawaii, Australia, Canada, Italy, India, Malaya, and Sweden, as well as from many other countries.

In the event that your summer photography nets some pictures or slides that you think are particularly good, I suggest that you contact the exhibition chairman, H. J. Johnson, at 2134 Concord, Chicago 47, Illinois. Even though entry blanks may not be ready yet, you can find out about particulars of the 1952 exhibit, and be preparing your pictures for it.

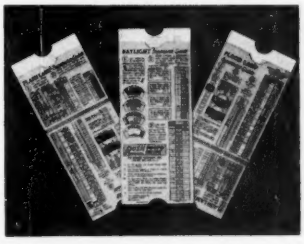
To show the type of material used in the international exhibit, several prints displayed last year are reproduced here. The barn swallow picture, taken by Eliot Porter of Sante Fé, New Mexico, received an honorable mention. Similar awards went to "Dangerous Curves" by Mike Bishop of Woodhaven, N. Y., and to "Family Group" by Grant Haist of Rochester, N. Y.

While the picture, "Cold Storage," by Roy Schubert of Downers Grove, Ill., did not receive an award, it shows what the photographer can do with simple properties — in this case a couple of oak leaves and an expanse of snow. This, of course, is not a summer shot. But it is a possibility to keep in mind until the proper time comes next winter.

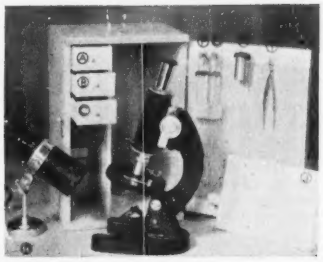
SHOP TALK

A great deal of material has accumulated since the previous "Camera Trails" was written two months ago. Accordingly, I think I will devote the remainder of this section to a discussion of the various supplies and accessories that have been

(Continued on page 387)



This new Rush Photo Guide works on the principle of a slide rule; fits in pocket.



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HOSPITALITY FOR HUMMERS

(Continued from page 347)

tractive to a blue-throated hen hummingbird. This is made on the plan of a watering device widely used for laboratory animals. Fundamentally it consists of a bottle with a rubber tube of small diameter run through the cork. When inverted, a drop of liquid hangs constantly from the end of the tube. A netting of light copper wire, or string, holds the bottle and a flower, artificial or natural, is fastened to the end of the tube. This was originally contrived for the purpose of getting birds in position for angle shots from below. It turned out, however, to be a fairly useful general-purpose feeder.

Where hummingbirds are numerous, as they always are during the summer at the mountain cottage of Mr. and Mrs. W. R. Willis at Chipita Park, Colorado, feeders of good capacity are required. The one shown with a close-up of the female broad-tailed is made from a chemical laboratory flask inverted over a straight-sided dish and held in a wire support to which a perch is also added.

The simplest feeder of all is a bottle hung with a bit of wire twisted around the neck. One such was a penicillin vial with a circle of red rubber cut from an old hot water bag around the neck and did service to simulate a flower.

Ants, bees, and wasps sometimes become troublesome. Ants can be barred with common automobile cup grease, or with a sticky "insect barrier" obtainable at seed stores. Bees and wasps can be excluded by covering the dish in which syrup is exposed with a tin or plastic lid through which holes, of about three-sixteenth of an inch in diameter, have been drilled. This is small enough to bar the insects and large enough for the hummingbird bill.

Thus anyone who has seen hummingbirds visit the home garden and wished to extend hospitality to these charming little visitors can attract them by simple means combined with patience and ingenuity. The results are far in excess of the little effort and expense involved, and the pleasure of having these beautiful little hummers about cannot be measured.

ARCTIC SUMMER

(Continued from page 356)

Snow on the mountain turned pink. The white wraith of the crescent moon dropped in the west. Shadows at midnight were cast by the passengers walking in the slanting sunshine.

How fortunate that the islands at the north of us were low, giving us the whole display, and that those on the east were high to reflect the delicate pinks of a sunset that was not a sunset.

The sun dropped lower, turned redder, seemed smaller. I stood at the stern, and my hands were cold for jotting notes. I wore every scrap of warm clothing from my travel wardrobe, but some of the Norwegians wore neither overcoats nor sweaters. Bob borrowed my dark glasses to take pictures of the sun.

The mountains turned to rose.

At twelve, the east was full of sunrise light. At quarter past twelve, the sun was large again, casting stronger, brighter rays upon the mountains. It grew huge. The golden water-path was wide. In the exquisite beauty of a midnight Arctic scene at sea, the new day, touching the fingers of the day just past, was bright with sunshine.

AUGUST AND SEPTEMBER SKIES

(Continued from page 381)

for observing this planet, and it will be difficult to find low in the west after sunset. It will remain in the evening sky until it is in inferior conjunction with the sun on August 31, after which it will be in the morning sky. The western elongation, which will occur on September 16, will be a favorable one, and the planet will be seen for a number of days before and after this date in the morning twilight in the eastern part of the sky. It will be brighter than Vega and should be easily found not far from Regulus in Leo. Venus will be low in the western sky in August, and is too close to the sun to be seen for some days before and after its conjunction with the sun on September 3. By the end of September it may be seen low in the eastern sky before sunrise. Mercury and Venus will be in conjunction with each other in the eastern morning sky on September 12.

Mars is in the morning sky, passing from Gemini through Cancer into Leo during these two months. It rises from two to three hours before the sun, but does not become as bright as a second magnitude star until the beginning of October.

Jupiter, in August, rises several hours after sunset and is conspicuous the rest of the night in the constellation of Pisces, where it remains through September. By the end of that month it rises directly after sunset and is visible throughout the night. With the exception of Venus it is the most brilliant of the planets, far outshining Sirius, brightest of the stars.

Saturn is in Virgo, west of Spica, setting soon after sunset in August and disappearing in the evening twilight in September. It will be in conjunction with the sun on September 29, when it will pass to the morning sky.

17th Wildlife Conference

Miami, Florida, has been chosen as the site of the 17th North American Wildlife Conference, which will convene there March 17, to 19, 1952. The Conference is annually held under the auspices of the Wildlife Management Institute, and it is also the occasion for a number of related meetings. This is the first time that the Conference has been held in the Southeast. Sessions will be held in the Miami Municipal Auditorium overlooking Biscayne Bay.

Nature Sanctuaries

Announcement is made by The Nature Conservancy of completion of an inventory of "Nature Sanctuaries in the United States and Canada," and the publication of a report of the study as the winter issue of *The Living Wilderness*, official publication of The Wilderness Society. The list includes 691 Nature sanctuaries. Copies are available for fifty cents from Dr. S. Charles Kendeigh, Vivarium Bldg., Wright and Healey Streets, Champaign, Illinois.

Murrill Discovery

Dr. William A. Murrill, discoverer of the chestnut canker and gold medalist of the Holland Society for his mycological researches, has now an important medical discovery to his credit. In a wild Florida mushroom, which he discovered and named *Clitocybe subilludens*, there is a substance superior to ergot, the childbirth medicine. The substance is now being prepared for manufacture.

Tape Recordings

Conservation, Nature study and general science are included in the library of tape recorded programs available from the Corneli Tape Recording Center, Roberts Hall, Cornell University, Ithaca, New York. A catalog of programs is available on request to that office.

ANSWERS TO THE TREE STORY ON PAGE 360.

The names of other woody plants than those suggested below may be substituted. For example, Red (wood) and Cherry would serve equally well for blanks numbered 1, 2, or 3.

1. Rose (wood). 2. Hazel. 3. Myrtle. 4. Palm. 5. Beech. 6. Wall (nut). 7. Ches (nut). 8. Butter (nut). 9. Bigtimber, Box Elder, Whitepine, Willow Creek, or Poplar, Montana. 10. Laurel (s). 11. Alder. 12. Beech. 13. Cedar. 14. Plum. 15. Peach (es). 16, Elm, or any other tree. 17. Tree of Heaven (*Ailanthus altissima*). 18. Pear (s). 19. Apple. 20. Spruce. 21. Rubber (Tree) (*Ficus elastica*). 22. Birch. 23. Elder. 24. Pawpaw. 25. Hickory. 26. Crab (apple). 27. Oak. 28. Ash. 29. Yellow Wood (*Cladrastis lutea*). 30. Butternut. 31. Cherry. 32. Balsam. 33. Cypress. 34. Tulip (s). (Tuliptree — *Liriodendron tulipifera*). 35. Willow. 36. Yew. 37. Pine. 38. Fir. 39. Chestnut. 40. Date. 41. Fir. 42. Ginkgo (*Ginkgo biloba*). 43. Sorbus (Mountain-ash — *Sorbus americana*). 44. Dogwood. 45. Lemon.

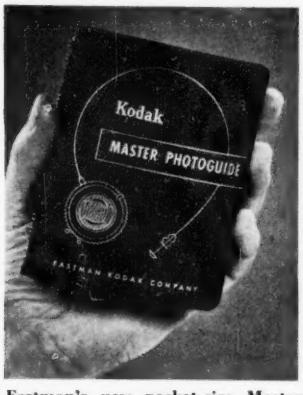
(Continued from page 385)

The Port-A-View projector viewer enlarges slides more than four and one-half times, can be used in room light.

made available of recent date.

Eastman, for example, has combined features from many of its Kodaguides into its new Master Photoguide, a neatly bound little book of just the right size to fit in a pocket. Exposure and other information in the book is slanted toward still photography with either black-and-white or color film; the guide can be used both with and without an exposure meter. It does not cover motion picture photography.

Material it does cover includes general hints on correct exposure, a discussion of subject types and daylight lighting, a daylight exposure computer, information on picture taking in daylight situations both common and unusual, data on color



Eastman's new pocket-size Master Photoguide is packed with information.

photography at night, a floodlight computer, flash exposure guide numbers and a flash exposure computer, copying data, and an effective aperture computer. All that, you must admit, sounds like quite a pocketful of information. Available through all Kodak dealers, the guide sells for $1.75.

In connection with the Color Handbook announced just a year ago in August, Eastman has sent out the first of a series of color notes to registered owners of the handbook. It fits into the ring binder and deals with items of interest to color photographers.

Another type of guide has been prepared in slide rule form by the Rush Photo Guide Division of the Eraser Company, Inc., 104 South State Street, Syracuse 2, N. Y., to help the photographer decide on correct exposure for daylight, flood, or flash pictures, and for both black-and-white and color. It takes a while to figure out what all the little windows, letters, and figures mean but, once mastered, the guide does serve as a quick and handy slide rule. Eventually it will be marketed, but at present the Rush Photo Guide is obtainable only from the manufacturer at the address given above.

The chief disadvantage of color transparencies, to my way of thinking, is the difficulty one has in viewing the slides after they are processed. With a projector, unless one has access to a darkened room, it is necessary to wait until dark to see them properly. Also, with such an arrangement, there is the business of getting out the projector and the screen, taking the slides from the place where they are stored, and then putting everything away again when the show is over.

A table-sized viewer is convenient, in cases where the size of the image is not important. A number of companies have placed models of these on the market. Most recent addition to the group is the Port-A-View projector viewer manufactured by the FR Corporation of 951 Brook Avenue, New York 56, N. Y.

This viewer folds up like a camera into a 2-7/8 x 6¼ x 10½ inch box that weighs four pounds. Its dark TV-type viewing screen is approximately six inches square and on it the slides are enlarged better than four and one-half times. The slides can be projected successfully in ordinary room light. Behind the screen a plunger-type slide changer holds 36 slides which move into position one at a time at the will of the operator. Price of the viewer is $49.95 complete.

In the polaroid field, flash guns are now available for the picture-a-minute cameras — a standard battery type and a long-life capacitator model which fires the bulb by a condenser charge.

Astronomy Photos

Since 1903 the Yerkes Observatory of the University of Chicago has been building up a tremendous astronomical photograph supply. These are in the form of lantern slides, transparencies and prints. They are now being made available, in part, for public use and a catalog has been issued under the title of "Astronomical Photographs." Orders and all communications may be addressed to The Photographic Service Department, Yerkes Observatory, Williams Bay, Wisconsin.

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National Association of Biology Teachers

THE ELUSIVE FACTS

By George Jeffers

As I write, my boy who is a junior in high school, is wrestling with an assignment in English. It seems that every pupil taking English is required to turn in an essay on The Conservation of Wildlife, or some related topic. The essays will then be submitted in competition for a prize offered by the Virginia State Commission of Game and Inland Fisheries. A year ago, confronted with this same assignment, Jack was completely baffled. On that occasion he appealed to me for help and, as many a dad before me, I complied, but only to the extent of suggesting a topic. "Why," said I, "don't you write about your hobby?" It happens that Jack knows more about archery than any other person in school and, with "Archery and Wildlife," he was off like an arrow.

Now, even his best friends do not consider Jack a student, but for the next two weeks he had us fooled. He put in more concentrated independent work on that essay than I had ever seen him do before. He labored and brought forth, not a masterpiece to be sure, but the best he had in him. Was he proud of his accomplishment? Never one to belittle his own prowess, he easily convinced himself that some designation higher than "A" would have to be invented to do justice to that paper. With what result? You have guessed — the paper got a resounding "D," with the notation that it did not cover the subject. Poor teacher! Little did she realize what a pat on the back might have done for a boy who had hitherto shown little taste for English. Poor teacher? No, poor Jack! — brushed aside to rejoin the swelling ranks of the might-have-beens.

I have no quarrel with using the prize-possible essay as a device for teaching composition. The concensus seems to favor the vicarious teaching of conservation over teaching it as a distinct subject. Neither do I object to teaching it in the English classroom, or in classes in social science, or in any other, although what is everybody's business often turns out to be nobody's business. What concerns me, rather, is how conservation is taught in the biology classroom, since it has more affinities with biology than with any other school subject, and we may expect the major load of conservation teaching will continue to be carried by the teacher of biology.

The raw materials of any science are facts. But facts have an elusive quality and must always be handled with respect and, above all, with fidelity. Two common pitfalls in the handling of facts are to be avoided — the drawing of inferences from too few facts on the one hand, and the transferring of conclusions derived from one set of facts to a situation that bears only a superficial resemblance to the first. Both sins have been committed in the name of conservation. Let me elucidate by examples drawn from the area of marine resources, an area where stubborn facts have often risen up to confound the best of good intentions.

The student who has been trained in the ways of wildlife may be unprepared for conditions of life in the sea. On land, man is considered the great disturber of Nature's balance, and he has often been assigned an equally important role with regard to sea life, a villain's piece to which he may not be justly entitled. The fact is that marine species are subject to wide variations, out of all proportion to fluctuations encountered on land. The causes of such fluctuations are not well understood. They are often cyclic in nature, and they seem to be largely if not altogether independent of man-made causes. Of course, for species such as the salmon that ascends rivers to spawn or the oyster restricted to a certain type of bottom, human interference may have serious consequences, but even here the consequences can be easily overdrawn.

It is deceptively easy to ascribe fisheries fluctuations to human interference, however. The case of the Hudson River shad may be used as illustration. During the 1850's the Hudson shad run was at a low ebb, but during the 1870's and 1880's there appears to have been a gradual increase in abundance, which was generally credited at the time to hatchery operations that had been stimulated by the preceding scarcity. In the present century there have been a fresh decline and a fresh recovery, the latter attributed to restrictions placed upon netting. And yet, notwithstanding these regulations, the catch has fallen in still more recent years from a high of almost 4 million pounds in 1944 to barely a million pounds in 1950.

When a commercial species becomes scarce, people want to "do something about it." Most fisheries regulations are formulated during such periods of scarcity. Most regulations are restrictive, that is, they limit the season, or the gear, or the catch. In other words, most regulations foster inefficiency in an industry already characterized by inefficiency. By the time the cumbersome legislative and administrative wheels have ground out such restrictive measures, the population in question may have already started on the upcurve — and the regulations get credit for the recovery.

One aspect of fluctuations is that associated with survival of eggs and young. It is well known that most marine species are exceedingly prolific. And yet, there is little correlation between the number of spawning adults and the ensuing survival. A classic illustration is provided by the 1934 year class of striped bass or rockfish in Chesapeake Bay. The rock fishery of 1934 was a poor one, and we may assume that the corresponding brood stock was also small. Nonetheless, the number of young hatched and surviving that year was phenomenally high, so much so that this particular year-class dominated the fishery for the next several years. The teacher who looked only at the low 1934 catch might have joined the chorus of those affirming that the striped bass was on the decline. However, a graph showing the ups and downs since the beginning of the fishery would have presented a clearer picture. Here again we are almost entirely at a loss for an explanation of this recruitment, as it is called.

Examples could be multiplied. They all serve to make one hesitate before ascribing any one factor as the cause of an observed phenomenon. However easy it may be, it is hardly reliable to dogmatize from similar though hardly analogous conditions ashore. The plain fact is that we know very little about the dynamics of marine populations. While we may not be able to rule out overfishing as a factor for scarcity, we can say that the case for overfishing has not been proved.

We have now reached the stage in marine inquiry where we can sympathize with Lord Melbourne when he cried out: "I wish I was as cocksure of anything as Macauley is of everything." We do not know the answers to many of the behavior patterns of marine creatures, because we have been trying to get along on a paucity of reliable information. We have become conditioned by land-use conservation and the transfer of land practices have not stood us in good stead. In such circumstances, the sensible thing to do is to procure the basic information required to formulate reliable and predictable patterns of behavior. Much more information is needed about the various oceanographic conditions both physical and biological before we can know the underlying principles which govern a species' behavior, availability, and total abundance. Fortunately, we seem to have already entered upon such a period. Investigations to obtain such information on a number of fronts are now in progress — the International Herring Investigations now going on in and about the Gulf of St. Lawrence; The Chesapeake Bay Institute, The Lamprey Studies in the Great Lakes, and the California Sardine Research Program — to mention only a few. Notwithstanding the titles, these studies for the most part are not palliatives. They are cooperative studies designed to arrive at fundamental conclusions. They promise to fill in many of the gaps in our present knowledge about conditions of life in the sea. When all the factors involved are better understood, we will be more surprised at stability than fluctuations. Until that time comes, it is our duty as teachers to be cautious and critical.

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UNDER THE MICROSCOPE

By JULIAN D. CORRINGTON

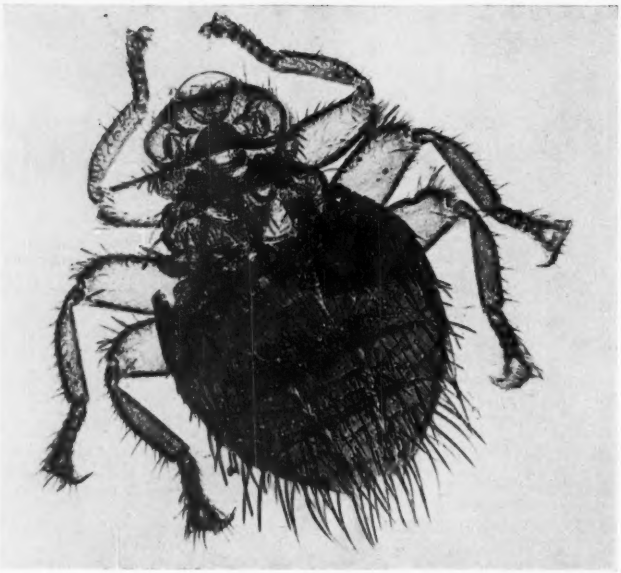
THE BEE LOUSE

THE idea of so small an animal as a bee having lice on its body seems absurd, and immediately brings to mind that old jingle about big fleas having lesser fleas upon their backs to bite 'em. But this is just one more example in an endless series of instances that truth is stranger than fiction, for there *are* such creatures, and we herewith present the portrait of one to show what he looks like. Odd-looking character, eh what?

Our subject is named *Braula coeca* in scientific circles, and *bee louse* in all modern European languages, as the German *Bienenlaus* and the French *le pou des abeilles*. Although first described by the great French entomologist Réaumur, in 1740, this tiny insect has doubtless been known to the apiculturist for a much longer time, since bee-keeping is an ancient art, and so relatively large an incumbent could scarcely escape all notice. Actually braula is not a louse at all, but a degenerate and very highly specialized fly. In entomological terms, it is a member of neither the Mallophaga, or Biting Lice, nor the Anoplura, or Sucking Lice, but of the Order Diptera, the mosquitoes and flies. However, since it will be most convenient to continue usage of the long-established name, and avoid lengthy circumlocutions, we shall continue calling this animal the bee louse and use its generic name, without the capital initial, in lieu of a common name.

Braula is tiny — 1/16 inch long — but many mites are far smaller than this. As sizes go at this level, the bee louse is relatively large in comparison with its host, which is exclusively the honeybee, *Apis mellifera*. Inasmuch as this bee is a foreigner to America, so too is braula. It is found clinging, singly or in numbers, to the bodies of any of the bee castes — some investigators report it only from queen bees, others from queens and drones, still others have seen it on workers. The conclusion is that braula may go for a ride on any caste, but prefers queens, drones, and workers in that order. Usually there is one louse found per bee (if there are any infestations at all), but higher counts are frequent, some so large as to appear utterly fantastic and impossible, as the report of 187 bee lice from a single queen. One conclusion is that the observer mistook mites or some other and much smaller creature for braula.

Not only are bee lice not lice, but there has been much discussion as to whether or not they are parasites. While the problem still needs further work, it is certain that braula does not pierce the body of the host in any manner. It rides about upon adult bees and robs them of food, so that it might be termed a nutrient parasite. Its antics have been described by Pérez, in French, in 1882, and by Lósy, in Hungarian, in 1902, both papers summarized by the best-known American expert on bees, E. F. Phillips, in a U. S. Department of Agriculture publication (Circular 334) in 1925, a report now out of print. Braula runs about over the bee's head, stamping its feet as if excited or angry, and periodically resorts to the host's mouthparts, where it procures a drop of nectar or saliva. Lósy described the louse as forcing the bee's mouthparts to separate and, with its own proboscis, compelling the bee to protrude and spread its tongue so as to give the louse access to the opening of the salivary gland. He feels that braula is both a burden and a torture to the bee. If this is so it is strange that most observers report that the bee apparently pays no attention to its passenger. Essig, however, says that the stronger and more active workers have been seen to rub the louse off their bodies.



***Braula coeca*, 60X. Photomicrograph from Flatters and Garnett, Ltd., Manchester, England.**

The bee louse is the only species in the Family Braulidae. It is reddish-brown, and has no wings at all, nor any sign of the modified second pair of wings, known in the Diptera as halteres, found on almost all flies. The compound eyes are vestigial and there are no ocelli or simple eyes. The head is large, with an unusual width for a fly; the antennae are short and concealed in a groove. The legs are long, well clothed with hairs, and end in two pear-shaped pulvilli and in two claws that take the form of a comb, each with 15 or 16 teeth, well shown in our illustration, and useful in clinging to the host.

From several studies on the life cycle of this peculiar fly, it appears that the eggs are laid in scattered fashion over the brood cells of a hive, and hatch into regulation muscoid larvae (similar to those of a house fly) that proceed to burrow through the comb and dine upon food brought there for the bee larvae, including the honey. Thus these flies do not, as formerly thought, belong to the Pupipara, a division of the Diptera that includes such species as the so-called sheep "tick" and in which the larval stage is passed inside the mother, the insect at birth being a mature larva ready to pupate. The assignment of braula to this group was purely by analogy, thinking it a blood-sucking ectoparasite, which it is not, and without basis on actual observation.

Argo (1926) overthrew the former idea that braula was a parasite that pierced the back of the honeybee to suck out its body juices, and proved that the adult feeds on nectar extracted from the bee's mouth, confirming the earlier work of Pérez and Lósy, and went on to show that the real damage, if it may be so regarded, comes from burrowings of the braula larvae in the honeycomb cappings. He states that the eggs are laid under these cappings, presumably just before the cell is completely covered. The tunnels, small at first, are enlarged as the larvae grow, although never exceeding 0.5 mm in diameter, and somewhat resemble those of the lesser wax moth larva. There is no evidence that the worker bees are aware of these foreign larvae.

After about 20 days (Phillips) the adults emerge from pupae which may have been

situated either inside or outside the hive cells. They may then ride about on adult bees and it must be in this manner that they are occasionally enabled to transfer from one hive to another, although the literature is silent on this point. Not much information is forthcoming as to the status of braula in the United States. It has frequently been reported from Maryland (Phillips, 1925; Cory, 1936) and also observed in West Virginia (Peairs, 1929), Pennsylvania (Hess, 1918, first record for America), Illinois (Milum, 1940), Minnesota (Whedon), and Ohio. A letter from State Entomologist Thomas of Texas informs us that there is no record of braula ever occurring there.

In Europe braula is found in Germany, France, and Italy, apparently this section being the center of its dispersal. Cheshire records it from England, but states that it seldom survives the British winter. It has been observed in Holland, Austria, and Czechoslovakia, but is said to be absent from Russia. Elsewhere it has been recorded in South Africa, Brazil, and Argentina, but not in Australia. Essig adds Tasmania and Japan to the list, so the species has been introduced, incidentally to importation of the host, and has become more or less established, in most parts of the world.

American beekeepers do not consider this creature a pest of any significance, and worry a great deal more about wax moths and foul brood. Nevertheless, as Phillips insisted, a considerable number of bee lice in one hive cannot be of any benefit. They may weaken their hosts and it is wisest to eradicate them. He shows that in Europe it is believed that braula infests primarily weak and badly-managed hives, but the statement is not made as to which is cause and which is effect; more work is needed on this point. Smoking — or any other fumigation method — works well if carefully controlled, the lice succumbing before the bees do. If the smoking is stopped after the bee lice have fallen off their hosts, the pests may be picked up or swept out of the hive before they recover. Another method, from an anonymous German source, is to open the hive in the evening and sprinkle it thoroughly with honey water. When the bees clean up the diluted honey, it is claimed that they also remove the braula larvae.

We are indebted to M. J. Deyell, Editor of *Gleanings in Bee Culture*, and to James I. Hambleton, Division of Bee Culture, U. S. D. A., at Beltsville, Maryland, for valuable references in preparing this account, as well as to those works cited above.

Occasionally we are asked to suggest small research problems for the amateur microscopist; problems that do not require a great deal of time or skill or an exhaustive knowledge of literature and methods. The study of the bee louse is a good example of this sort of undertaking. Observations are needed as to occurrences in America, incidence on the three bee castes, whether or not a heavy infestation kills bees, whether a poor hive harbors braula because a strong, healthy hive gets rid of them, or whether braula infestation renders a good hive weak; how bees avoid or get rid of this pest, if they do at all; further and more detailed studies on the life history of this, one of the most curious of all insects, and more exact data on the precise relationship between the louse and the bee. We shall be glad to act as a clearing house for miscellaneous observations and notes and to publish them in these columns or pass them along to professional entomologists.

Baula is one of the most intriguing of subjects for a microscope slide whole mount. The material is not easy to obtain, as we have indicated, but if the microscopist can secure a few specimens, from local hives or by correspondence, they should be potashed carefully and handled after the fashion of mounting true lice or fleas. Unless the operator is experienced, he would do well to practice on common objects first, trying the rarer braula only after gaining some facility.

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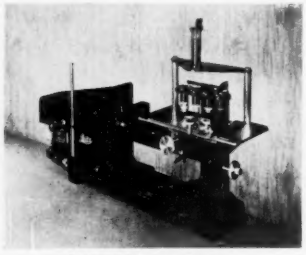

Leitz Microprojector.

FAMILY ALBUM
6. Microprojector

PROJECTION machines of one sort or another, from the simple magic lantern or its modern counterpart, the film-slide projector, to the most elaborate motion-picture projection equipment, probably constitute the most numerous and best known of optical devices, spectacles and mirrors alone excepted. Models range from homemade to professional, and from the inexpensive to the very costly, for a wide variety of purposes. Unsuspecting friends that drop in on the family that owns a modern projector must sit through an exhibition of kodachromes of the new grandbaby, or be taken on a condensed recap of that trip through Mexico last summer. Or possibly the scene is an executive room in a great corporation, where directors are looking at views of a proposed new plant, product, or process.

Among special kinds of projectors are those microscopes arranged to deploy their images upon a screen instead of the retina. Of course, any screen projection is magnified. The difference in principle between a slide projector and a microprojector is that the former presents an enlarged view of a picture, the latter a magnified image of the real thing. This point is often of considerable psychological importance in teaching, and we have known instructors to go to some length and expense in endeavoring to procure a microslide of an actual specimen to project, although a first-class picture of the same subject was readily available at no cost. For instance, it may be that a class of medical students are to attend a lecture where the instructor wishes to display screen pictures of the bacilli that cause bubonic plague, as well as of the rat fleas largely responsible for transmission of this terrible disease to man. The instructor may show pictures from books, by opaque projection, or photomicrographs made in the form of lantern slide transparencies; but the students will definitely be more interested and impressed if microscope slides of the real articles are projected. Each of these two kinds of projections is only an image, it is true, but a real image of a real object is several steps closer to actuality than an image of a picture, and gives the illusion of seeing the object itself. The observer has the perception, although he may not be aware of it, that the bacteria or flea are there, on microscope slides, which he can observe directly if he chooses.

The requirements for a microprojector are fundamentally but two — a light source and a microscope, and, accordingly, models can run the whole gamut in design and cost. Just as a stunt, and to illustrate the fundamental principle, we took a slide of *Braula coeca*, the bee louse, featured in these columns this month, and supported it in a position parallel to the table top by inserting one end between the top two of a pile of books. A sheet of white paper was placed on the table below and, with the room dark, a flashlight was held above, and a spectacle lens below the slide, giving a slightly enlarged image of the bee louse on the paper. The more important rules are — the stronger and more concentrated the light source, the higher the power of lens permitted, but also the more heat generated, often becoming such as to require absorbing cells, fans, or other devices to keep it away from the specimens; the higher the power used, the more urgent the need of a good condenser for the light, and also for rigid maintenance of correct alignment of parts.

Simplest of the commercial microprojectors are those that consist of a lamp housing for a small auto-headlight bulb, such as a 6V ribbon-filament lamp, operating on a transformer from the house circuit; in front of this is a stage with clips to hold the slide, and in front of this a small lens assembly, equivalent to a hand lens. At the commonly used projection distances, magnifications range in the 10 to 100X magnitude, and one of the more important employments for this instrument is for drawing purposes, the image being projected downward upon a sheet of paper, permitting rapid and accurate tracing of outlines and main parts of relatively large slide subjects, as embryos, insects, organ sections, or parasitic worms.

Next in degree of elaborateness would come the lamp housing and accessories on a base designed to hold the regulation laboratory microscope. The mirror is removed or turned aside, and special condensing lenses, cooling water-cells, and low power projection eyepieces are available. This saves a major item of expense, the microscope itself, assuming the user already has one. Lastly are to be mentioned those elaborate assemblies that consist of a special optical bed, on which are arranged the lamp housing, condensers, cooling cell, stage, and a special microscope, with special optics, that cannot be dismounted and used as a table microscope.

If images are to be projected on a vertical screen, as is usually the case, the projection microscope is generally in a horizontal position, the stage standing vertically. However, living cultures must remain flat and require a horizontal stage, in which case the microscope is in its more customary vertical position and the image is projected on the ceiling, if the size and nature of the room and the audience permit, or the light rays are changed to the horizontal by means of a mirror or (better) a 90° prism.

As an illustration to accompany this article, we have chosen the last word in microprojectors, a radical new design by Leitz, known as their model XI-c. A heavy metal base supports two items, the lamp housing and the microscope. The lamp is a clockwork-feed carbon arc, with aspheric condenser and iris diaphragm, the handle of which may be seen projecting from that tubular part of the instrument connecting the lamp with the microscope. Next comes a cooling cell with a heat-absorbing filter, then the microscope proper, which certainly looks nothing at all like the denizen of the biological laboratory with which we are familiar under that monicker. In the Family Album, this is an offspring that even its now mother would not know.

Magnification is varied by means of the central adjustment head, seen below the stage, which slides the entire stage platform back and forth. Each objective, above the stage, has its own built-in special condenser, below decks, designed to provide maximum illumination and definition. These objectives are all parfocalized and only for the highest power may it become necessary to turn the fine adjustment. Both coarse and fine adjustment controls operate on the same shaft, and are seen at the right end of the instrument, below the stage. A mechanical stage actuates the specimen slide.

The optical equipment, starting at the left in the illustration, consists of an apochromat 40X, achromat 14X, achromat 6X and, at the right, a Milar 40 mm coated f/4.5 lens without iris diaphragm, for macro-projection. This last has its own reflecting prism. The eyepiece for the apochromat is a Periplan 3X, and for the achromats a Huygenian 3X, interchangeable, and both used with a reflecting prism.

Designed to eliminate the usual fuss, bother and frequent failure of having to perform constant manipulations and changes of condensing lenses with each change of objective, meanwhile monkeying with the lamp feed or the focus, all the while trying to keep the mind on the subject about which one may be lecturing, this new model will be welcomed by those who can afford the best. As pictured here, this equipment will rap the old budget for a cool $1261.50, which puts it in the class of the ritziest of members of the Microscope Family.

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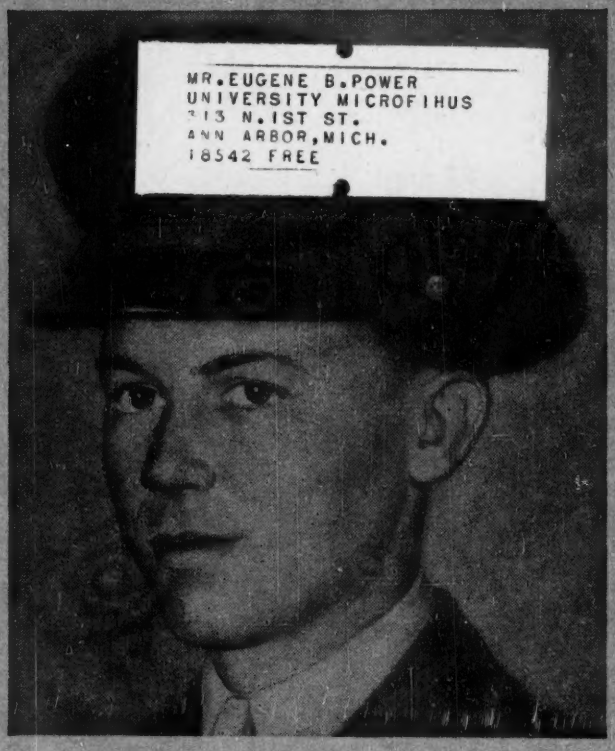

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